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Production Heat-Treatment of High-Speed Steel

By Ernest N. Brookings
Metallurgist, Jones & Lamson Machine Co.

IN THE manufacture of quantities of high-speed steel ground thread taps, threading dies, and lathe tools, it was desired to evolve a process of heat-treatment that would insure as far as possible a uniform quality product, and at the same time allow for quantity production.

The process and equipment are the results of considerable experimenting and practical experience in the heat-treatment of the class of tools mentioned. In Fig. 1 is shown the general arrangement of the equipment used for this work, *A* and *B* being tandem gas-fired oven furnaces used respectively for preheating and heating for hardening. The temperature of the former is maintained at from 1,550 to 1,650 deg. F., and the latter from 2,300 to 2,370 deg. F., both being dependent upon the nature of the work being treated. Conveniently located foot-treadles serve as means for opening these doors, which close of their own weight when the operator's foot is removed. An oven type electric furnace, *C*, is used for the drawing or tempering operation. The temperature of this furnace, as with the others, is dependent upon the nature of the work being treated, but is usually from 1,050 to 1,150 deg. F., and is maintained for a period of several hours for each charge. The quenching tank, *D*, contains continuously circulating quenching oil.

A slab of fire brick, *E*, is used as a table for loading the parts onto the nickel containers. These forms are

Fig. 1—Heat-treating layout for high-speed tools

shown on the brick and piled on the lower shelf of the preheating furnace. A clock for timing the hardening operation is shown at *H*, which is controlled by a switch at the furnace. This clock and control switch are shown in detail in Figs. 2 and 3. An electric bell is controlled by clock, and serves as a means of indicating the completion of the hardening period. The temperatures of furnaces *A*, *B* and *C* are recorded by Leeds and Northrup recorders shown at *K*, *L* and *M*. Hand control has worked out quite well for the preheating furnace so that *K* is simply a recording instrument, but *L* controls as well as records the temperature of the high-heat furnace *B*. This control is accomplished through two electrically operated solenoid valves, one for controlling the gas and the other for the air. The recording controller, *M*, automatically maintains the desired temperature in the tempering furnace.

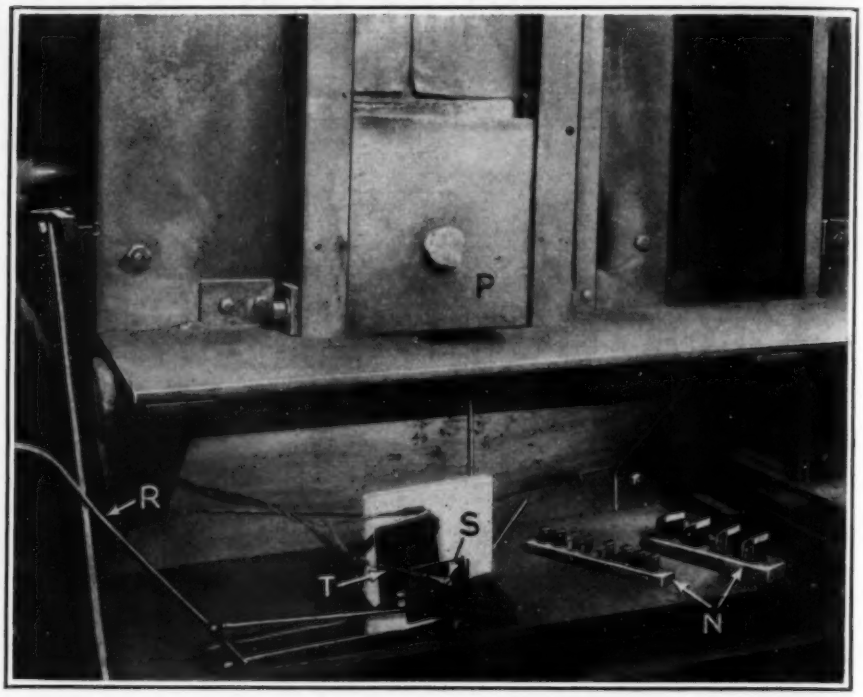


Fig. 2—Control switch for heat-treating furnace

The method of loading the threading chasers on the nickel forms is shown at *N*, Fig. 2. These chasers are made in a number of sizes, and for most sizes are made in sets of four, each chaser being numbered to determine its location in the die. Therefore, it proved both practical and convenient to heat-treat these parts in sets or multiples of sets. Consequently the forms were made to hold one or two sets of chasers, depending on the size. Obviously, more work could be handled in a given time if the forms were made to hold a greater quantity of parts, but it was kept in mind that it is considered advantageous to the proper heat-treatment of high-speed steel to complete the hardening operation as rapidly as possible without overheating the steel. In this way the desired amount of the carbides or tungstides, from which high-speed steel obtains its property of secondary hardness, is dissolved in the steel without undue brittleness caused by over heating at a temperature that is too high, or by soaking at a temperature that is too low. For this reason the number of parts handled at one time is kept low.

The number of these forms placed in the furnace at one time has been determined by experience, and is such that the time cycle will insure thorough preheating without undue soaking. As soon as the parts in the preheating furnace have become thoroughly heated, one of the forms is transferred by tongs into the high temperature furnace. Since in this movement the operator must reach inside the door of the hardening furnace, it is a natural motion for him to allow the handles of the tongs to rest upon the shelf in front of the furnace. The weight of the tongs is sufficient to depress the plate *P*, Fig. 2, and start the timing clock which has previously been set to operate the bell alarm at the termination of a predetermined length of time. As the operator removes the charge with his tongs, he allows the nickel block to slide along the shelf to the left and in so doing pushes rod *R* down, and to the left to its former position. This motion automatically causes the bell to stop ringing and at the same time sets the clock in readiness for the next charge. Continuing to move the charge to the left, the operator allows the contents of the nickel form to fall into the oil in the quenching tank, and then places the form upon the firebrick slab for reloading. The quenching tank has a specially designed cover to prevent the splashing of oil on the floor. Another charge from the preheating furnace is then placed in the high heat furnace, the operation of the control switch proceeding as before. During this heating interval the operator loads another charge of chasers onto the nickel form

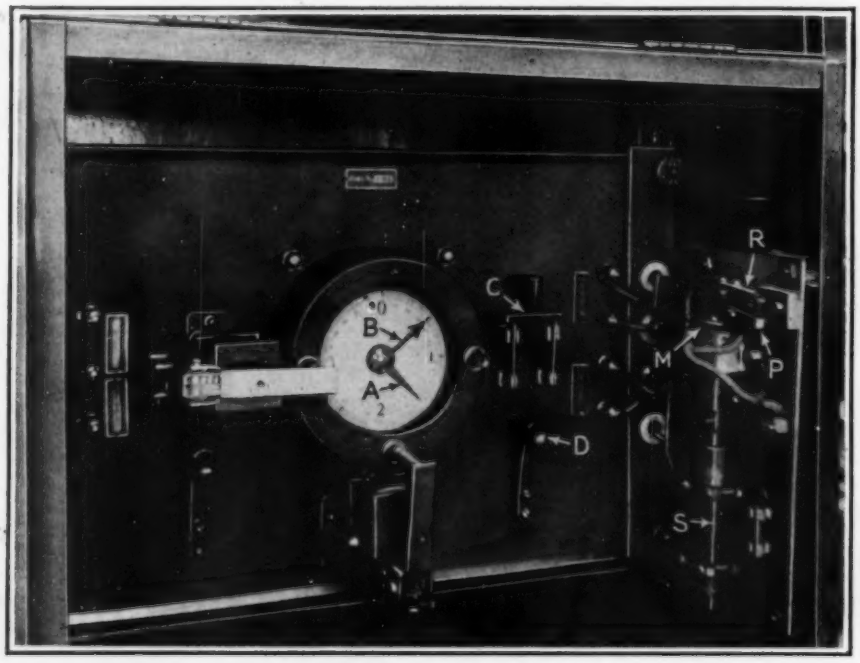


Fig. 3—Electric control clock for furnaces

on the slab and places the form in the preheating furnace. As soon as the bell rings the charge is removed from the hardening furnace and the chasers quenched in oil as previously. The nickel form is loaded and placed in the preheating furnace while the heating of the next charge in the high heat furnace is taking place. This sequence of operations is continued until the lot is completed, or until it is necessary to change the time cycle. The parts are then removed from the oil and placed in the elctric furnace for tempering. This operation continues for several hours, and then, after cooling and sand blasting, the chasers are in readiness for the subsequent grinding operations.

The control switch shown in Fig. 2 has admirably answered the purpose for which it was intended. Thus the depressing of plate *P* rotates the shaft of the switch and in so doing raises rod *R* up and to the right so that its end projects above the shelf of the furnace. This same motion also causes a pin to strike against the lower side of the diamond-shaped piece of fiber *S* forcing it to rotate about its axis until the pin has passed up and beyond it. The spring, *T*, then returns the fiber piece to its original position. However, in the brief interval that the fiber piece was displaced by the pin, an electric contact was made sufficient to cause the clock to start.

When the charge is removed from the furnace and the bent rod *R* pushed to the left by the nickel block the reverse motion takes place, and a contact is made that sets the clock in readiness for the timing of the next charge. The alarm bell continues to ring until this contact takes place. The asbestos sheets, *V*, are only to protect the springs and insulation from the heat of the furnace.

The electric timing clock shown in Fig. 3 can be purchased complete with panel and sheet metal case. It is operated by a motor deriving its power from the lighting circuit. It is adjustable by seconds of time to a maximum of three minutes forty-eight seconds. Hand *B* is made to coincide with set hand *A* in readiness for the timing operation by closing the switch *C* and pushing button *D*. Hand *B* then starts moving counter-clockwise toward the zero at the top of the dial. When this point is reached the bell rings until the button *E* is pressed, returning *B* to the set hand.

Controlling the Timer

Since it would be inconvenient and inaccurate for short periods of time to control the timer by means of buttons, the previously described control switch in Fig. 2 was constructed. The contacts made by the springs in the control switch produce the same results as depressing the buttons. In this manner the starting and setting back of the clock is controlled automatically by the operations of placing the charge into and removing it from the furnace. Since, however, the contact between the springs is but momentary, the time interval proved inadequate to insure the return of the clock hand. Therefore, the arrangement shown at the right of Fig. 3 was constructed. This attachment is electrically connected in parallel so that when *D* is depressed or when contact is made between the springs in the control switch, the magnet *M* is energized. The outer end of pivoted bar *P* immediately closes spring switch *R*, which normally remains open. Once this switch is closed the magnet will continue to be energized. The passage of current through magnet coil *M* attracts the steel rod *R*, and slowly draws it out of oil cylinder *S*. As this upward motion continues the circuit is opened. The magnet then ceases to be energized and the outer end of the bar falls by gravity, leaving the switch in its normally open position. The time necessary for the bar to raise and open the switch is sufficient to insure the return of the clock hand to the set hand at any position on the dial.

To provide for a continuous supply of nickel forms for the hardening furnace, a secondary floor of Q-alloy has been added to the preheating furnace *A*, Fig. 1, making this a double hearth furnace. Uniformity of preheating is assured despite possible temperature variations in the furnace by moving all forms along the hearths when one is removed, the next to be taken out being nearest the thermocouple.

The four burners of high-heat furnace *B* are made of pure nickel. The high first cost of these burners is more than warranted by the much longer life of the nickel as compared to burners of other materials. Replacement is necessary only about twice a year. The nickel forms for holding the work have been in continuous use for more than two years, and apparently will last as much longer.

Interchangeable Thermocouples

All three furnaces used in this heat-treating process are provided with chromel-alumel thermocouples. These are preferred to the platinum-rhodium thermocouples because of the greater sensitivity, and also because they may be used interchangeably with any of the recording instruments. The life of these couples in the high-heat furnace is short, and as a result of experience we make a practice of changing the thermocouple in this furnace every two weeks. The upkeep cost is somewhat reduced by the practice of making our own thermocouples. Porcelain protection tubes are used in both furnaces.

The curve drawn by the recording controller attached to the high-heat furnace shows that the temperature variation is very slight. The variation is dependent to a great extent upon the relation of the size of the charge to the furnace size. Obviously, a heavy charge in a small furnace would cause a more pronounced drop in the furnace temperature than if the opposite condition prevailed. Each lot of parts is given an identification number and each piece in the lot carries this same number. Most lots have all pieces tested for hardness by means of a Rockwell hardness tester, and records are kept of the results obtained. Microscopic examinations are also occasionally made as a further check on the uniformity of the heat-treatment. In this way the performance of various lots can be compared to their hardness and heat-treatment, and future treatments determined upon from the data obtained. Taps and lathe tools are heat-treated by a timing process similar to that described for the chasers, but of course many factors, such as time, temperature, furnace atmosphere and quantity heated at one time, may be different, and are determined by careful comparison of the performance with the steel and its heat-treatment.

Forty Years Ago

The Acme Machinery Co., Cleveland, is erecting a fine two-story brick shop 40x120 ft., and will have about 20 machines to start with. The shop and tools will cost $16,000.

The Brown & Sharpe Mfg. Co. has gotten out an improved annealing and casehardening furnace which can be run with a consumption of 150 lb. of anthracite coal per day, and has a capacity for hardening 400 lb. per day.

Safety Committees—A Necessity or a Nuisance

By L. M. Challis
Employment Manager, Copeland Products, Inc.

IT IS my belief that safety committees are a real necessity in modern industry. In our own plant the safety committee is a vital factor in accident prevention. The personnel of our safety committee is made up of the factory manager, the superintendent, the master mechanic, the inspection superintendent, each departmental foreman in the factory (nine in number), the company surgeon, and the employment manager—the factory manager serving as chairman and as secretary. The committee meets twice a month, and has special meetings at such other times as conditions may warrant.

In the majority of shops and factories, production is the dominant factor, and the man primarily responsible to the management for production is the foreman. Hence, it is quite natural that he should be an important factor in accident prevention. His presence on the safety committee, therefore, is equally as important to the management as his presence at a production meeting. The safety of employees is undeniably tied into production, just as much as is low manufacturing cost or the accurate planning and scheduling of materials. A successful foreman, therefore, will take advantage of his membership on the safety committee, as he represents, in our opinion, the crux of the whole safety procedures and practices. Safety thus becomes an integral part of his job in putting over the plant safety program.

Essential Features

Plant safety problems involve three essential features: education, engineering, and safeguarding. However, these elements will fall short of their objective, unless they are sponsored by an active, enthusiastic safety committee. Assuming that the management is convinced of the value and need of accident prevention work, safety committee should have for their purpose the following functions:

1. To be a channel through which a frank discussion of safety policies and practices may be had.
2. To make periodical inspections of the factory, and then to submit definite recommendations.
3. To review thoroughly the elements which contributed to an accident, and make the necessary recommendations to eliminate a recurrence. Constant education and instruction, together with proper disciplinary measures, are the only weapons available.
4. To invite and receive suggestions from employees regarding unsafe operations and practices they may observe.
5. To improve the spirit of co-operation and willingness between employees and management.
6. To make the safety plans, as developed in their committee meetings, a part of the operating policies on their own particular job.

The attitude of department heads toward accident prevention work will be reflected by employees, just as accurately as their attitude toward production is reflected. If the manager of the plant treats safety problems lightly, his "key" men will treat them lightly.

In a plant in which there is a well organized safety committee, a new employee does not present as great a safety problem as his presence would in a plant without a safety committee. The employment manager uses to advantage the lessons learned in safety committee meetings. The new employee is given a letter addressed to him personally from the factory manager inviting his interest in accident prevention and admonishing him to work safely. He is then taken from the employment office to his foreman, who introduces the new employee to his job; he points out carefully the hazards that may exist on the operation, and satisfies himself that the new employee understands the instructions. If the foreman may happen to be absent from the department, these matters are handled by the assistant foreman. The foreman later checks up on the new employee's absorption of the safety work, as well as on his progress with the other phases of the job.

When production is rapidly increased, or new construction is to be hurried along, these conditions carry with them a hasty distribution of new employees into the organization, and if these new employees have been previously working on jobs where safety has not been implanted in them, their presence constitutes a menace to the well-being of the plant safety program. This type of man has the impression that he has been given employment to tide over a busy season, and he is not prone to exert himself, either in holding up his end of the job, or in shouting his firm belief in the principles of safety. Here is a real need for the foreman's touch with such an organization as a safety committee. On the one hand, he realizes that when the first let-down in business comes along, this particular type will be the first to be laid off. On the other hand, he realizes that if any of them get hurt in the meantime, it means broken safety records.

The chairman of our safety committee holds department heads responsible for accidents and their cost, the same as they are held responsible for scrap in a production meeting. If a foreman is interested in his job, he is interested in cutting down the expenses connected with his department. His connection with the safety committee gives him excellent reasons, at close range, for adopting this attitude.

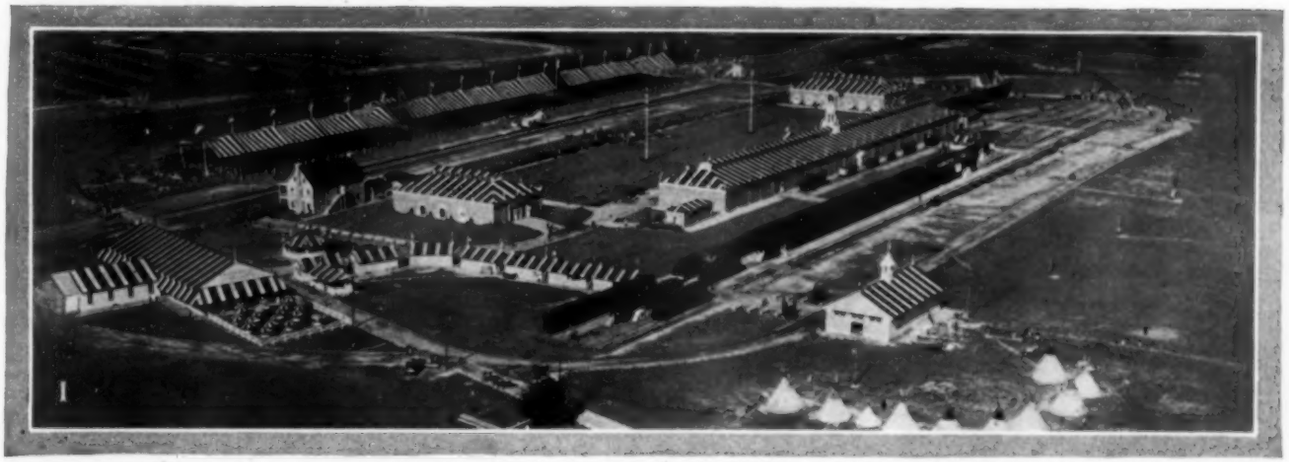
Abstract of a paper presented at the sixteenth annual Safety Congress of the National Safety Council at Chicago, Sept. 26 to 30.

Dating the Catalog

By G. B. Stuart

CAN anyone give a conclusive reason why the date is so frequently omitted from machinery and tool catalogs? It may be that some manufacturers feel that the trade will class their product with the "back numbers" if it is shown that they are still building what was given in a previous year's catalog. But whatever the reason, it seems more than offset by the arguments that can be brought out in favor of putting on the date.

The catalog files of many an engineering department are cluttered up with catalogs that are not thrown away because the pages haven't yet turned yellow enough to show their age. My argument would be to print the date on the catalog and get the prospective purchasers in the habit of writing periodically for new catalogs. The firm that doesn't want to replace its old catalogs is not likely to be doing things that show progress.



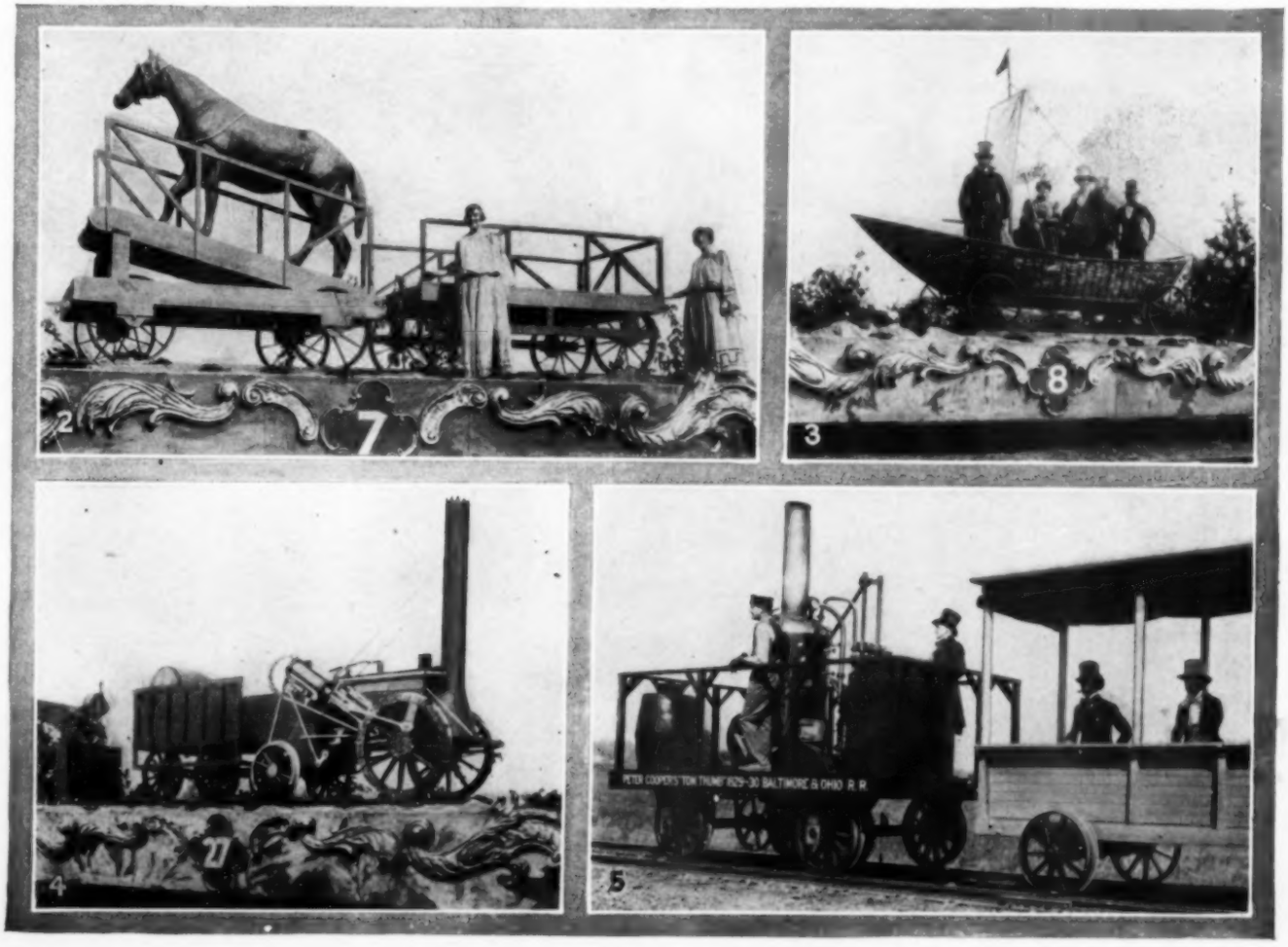
One-Hundred Years of American Railroading

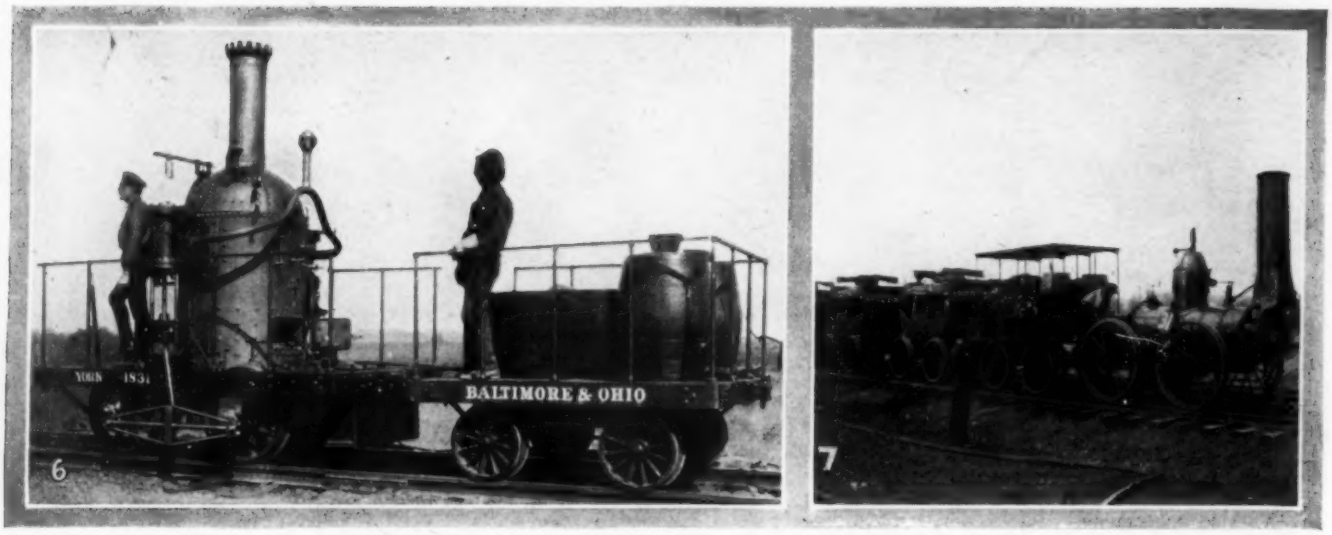
The Baltimore & Ohio Centenary

The Fair of the Iron Horse, Halethorpe, Md. September - October, 1927

THE growth of American railways and of the Baltimore & Ohio R.R. are synonymous—both began in 1827. Their development was shown in a most attractive and comprehensive manner at Halethorpe, Md. Some idea of the extent of the exhibit can be had from Fig. 1.

The Baltimore & Ohio R.R. was organized without definitely





selecting the motive power to be used. The tread mill and the sail car, Figs. 2 and 3, were both proposed.

Fig. 4 is a model of Stephenson's Rocket, 1829. This locomotive stirred Peter Cooper to build the Tom Thumb.

Fig. 5—A replica of the Tom Thumb, built in 1830. A general idea of the growth of steam locomotives can be had from the illustrations that follow:

Fig. 6—York, 1831—3½ tons. Built by Phineas Davis.

Fig. 7—DeWitt Clinton, 1831. Built at West Point Foundry for Mohawk & Hudson, now New York Central.

Fig. 8—John Bull, 1831. Built by Stephenson. Placed on Camden & Amboy, now Pennsylvania, November 12, 1831. Leading wheels added in this country.

Fig. 9—Atlantic, 1832—original locomotive—6½ tons.

Fig. 10—William Galloway, 1837. Built by Richard Norris. First locomotive on B. & O. with horizontal boiler.

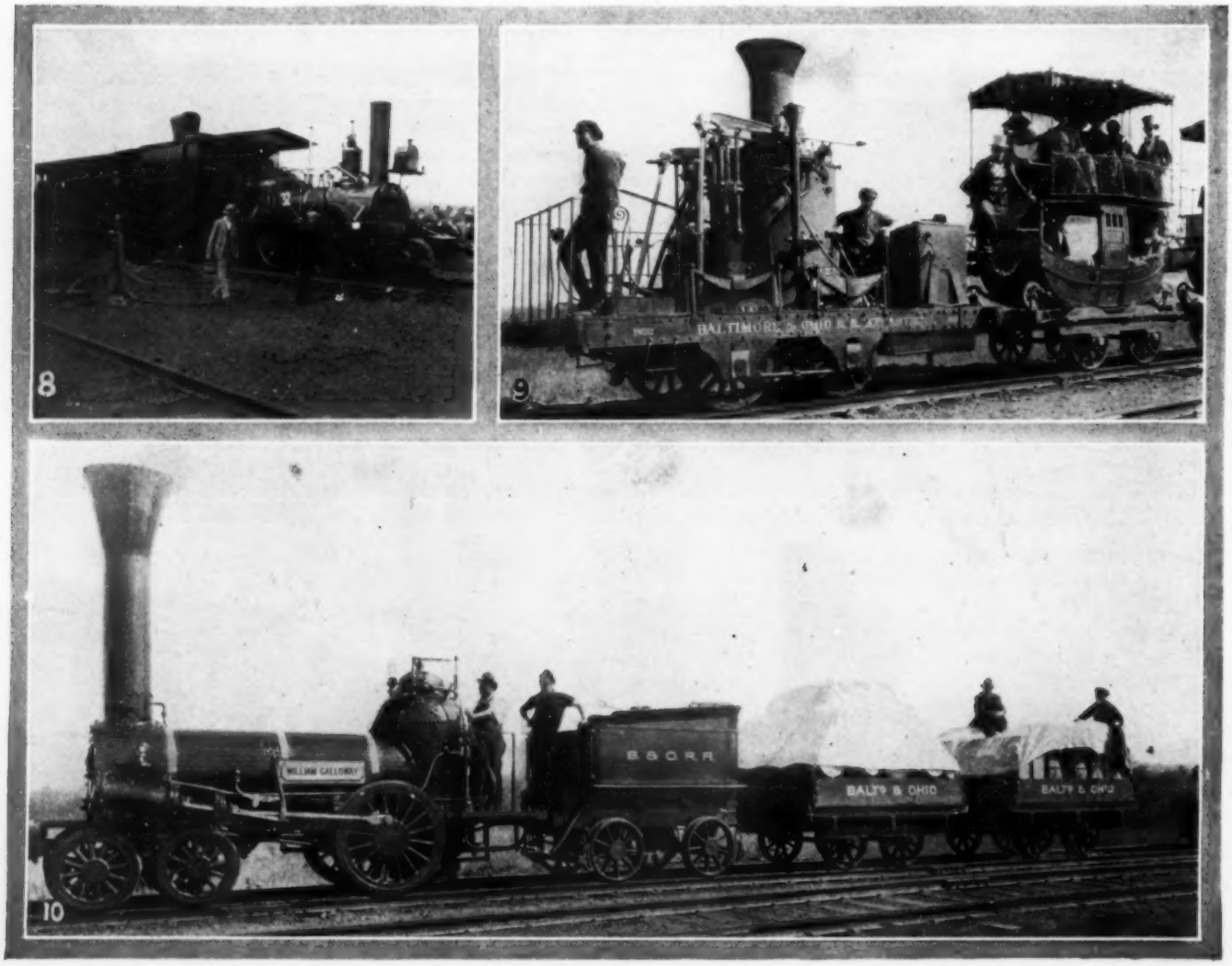


Fig. 11—North Star, 1837. Designed by Gooch. Built by Stephenson—7 ft. gage—7 ft. drivers.

Fig. 12—Memnon, 1848. Built at Newcastle, Del. Fast passenger engine.

Fig. 13—Pioneer, 1850. Built by Stephenson for St. Andrews & Quebec R.R.

Fig. 14—General, 1855. Built by Rogers for old Western & Atlantic R.R. Captured and recaptured in Civil War.

Fig. 15—Mason, 1856. The pioneer of the American type locomotives.

Fig. 16—Winans, 1869. Original camel-back was built in 1848.

Fig. 17—King George V, 1927. Most powerful locomotive in Great Britain. Great Western Railway.

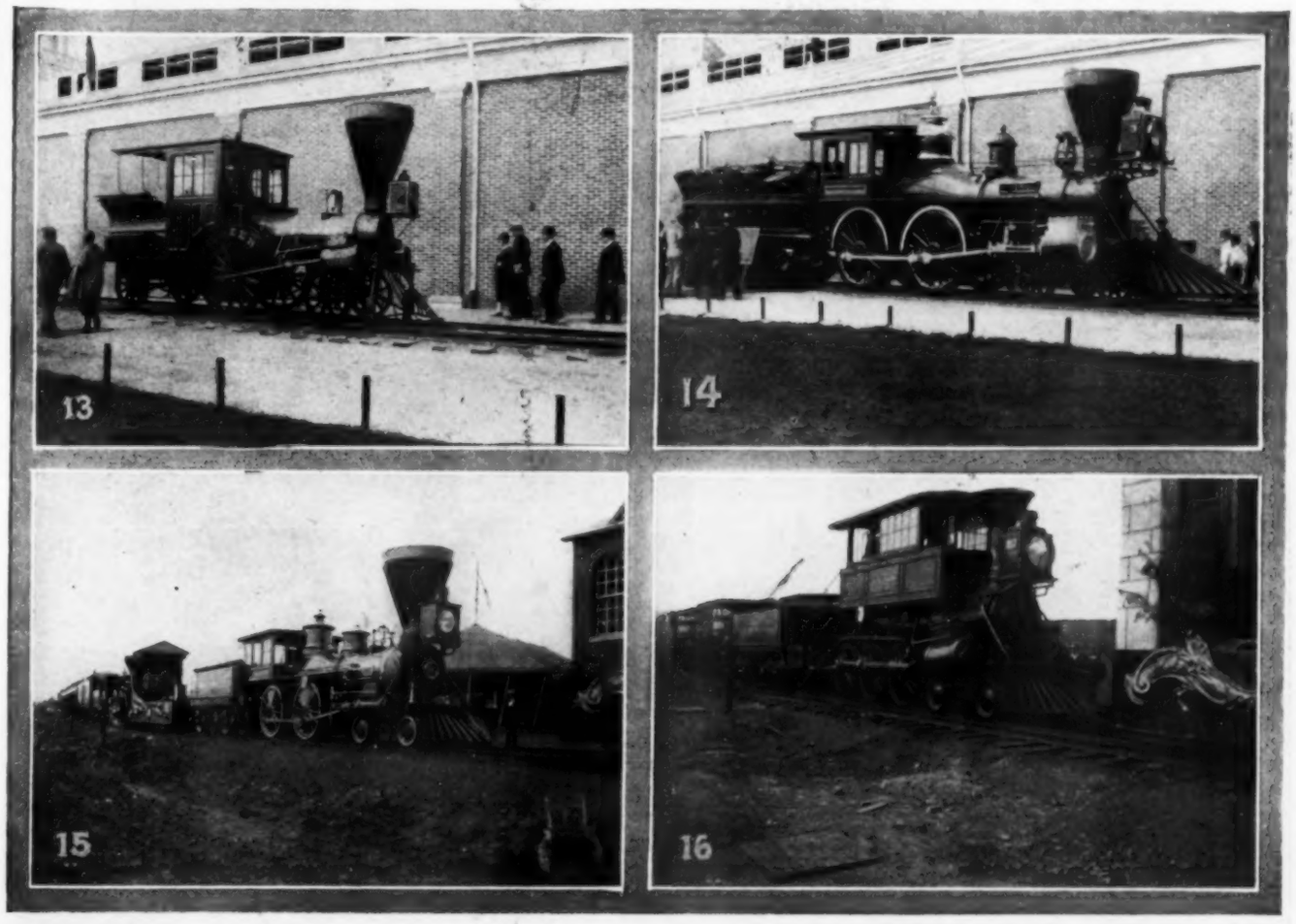
Fig. 18—Confederation, 1927. Canadian National Railways. Largest locomotive in the British Empire. Weighs 324 tons.

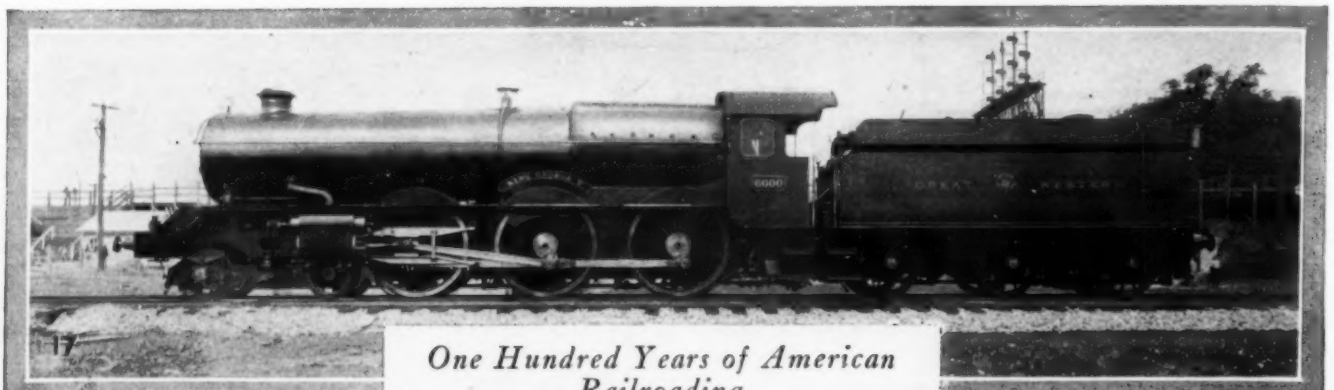
Fig. 19—No. 2333, 1926. Canadian Pacific locomotive.

Fig. 20—John B. Jervis, 1927. Built by American Locomotive Co. for Delaware & Hudson Co. Water-tube boiler carries steam at 450 lb. pressure.

Fig. 21—President Washington, 1927. Latest Baltimore & Ohio passenger locomotive. Painted olive green. Built by Baldwin Locomotive Works. Weighs 163 tons.

[See next page for illustrations of Figs. 17, 18, 19, 20 and 21]

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One Hundred Years of American Railroading

See page 647 for story of these locomotives

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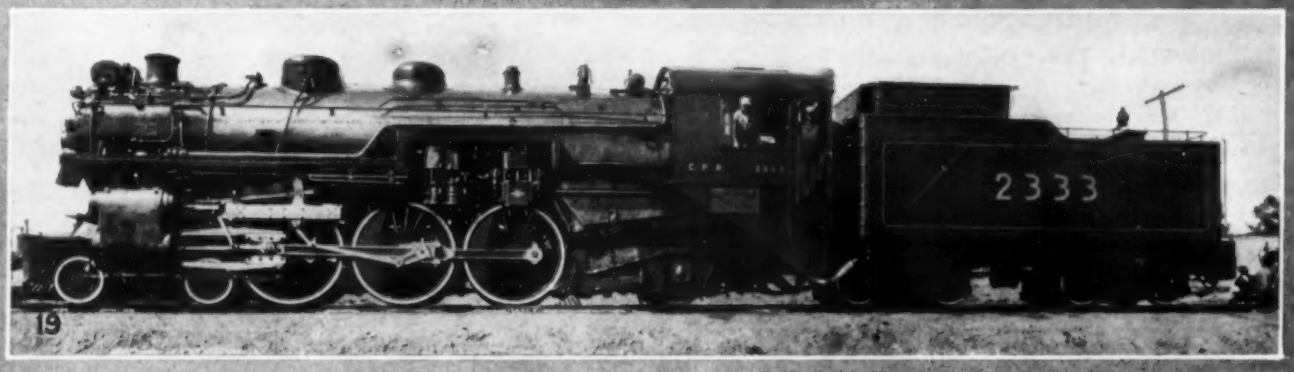

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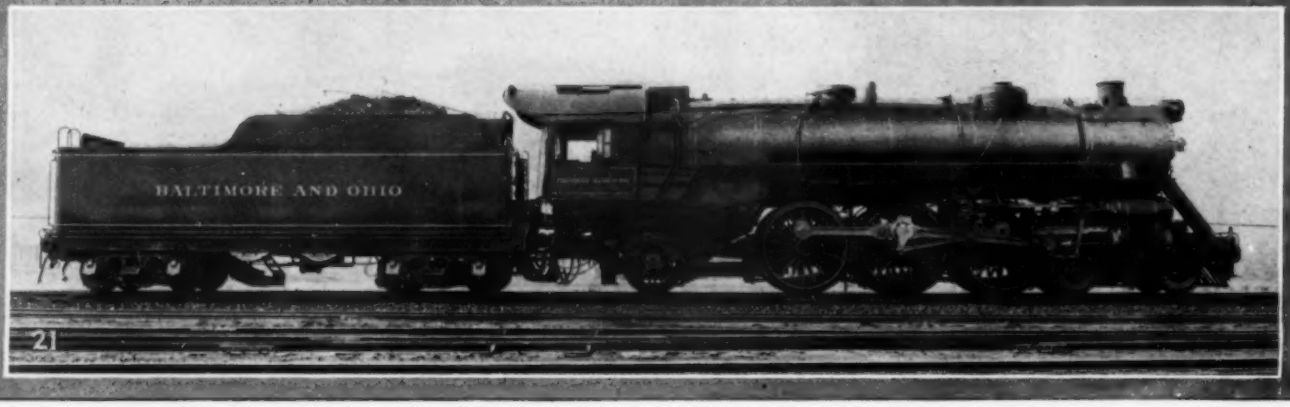

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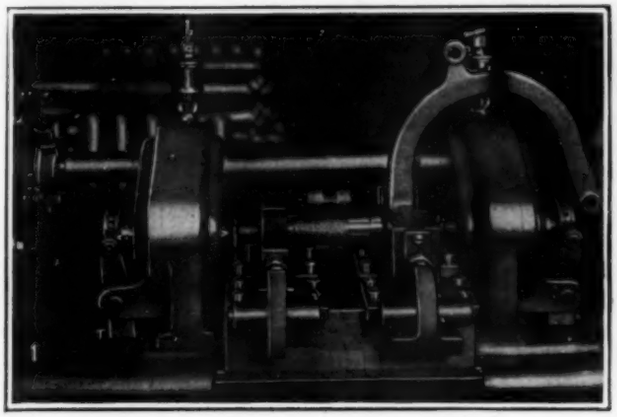
Automotive Production



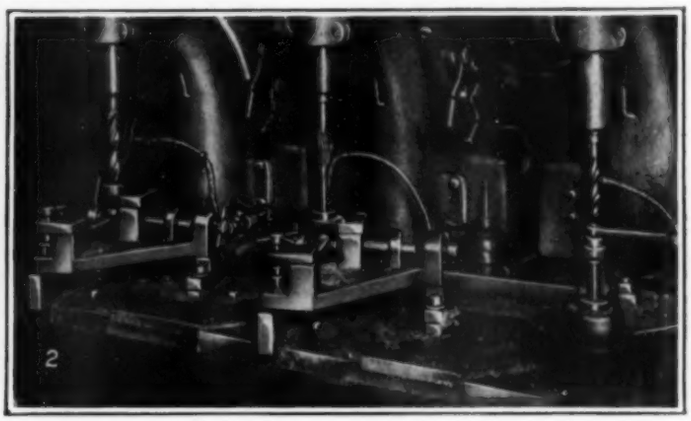


Fig. 1—Centering the axles of the steering arm on a special machine. Fig. 2—Drilling and reaming holes in steering knuckles

Centering and Milling Set-Ups

By Fred H. Colvin
Editor, American Machinist

THE methods employed in making the steering knuckles for the Franklin automobile involve several operations and include a special centering machine, as well as an unusual milling machine fixture. After annealing and cutting the ends to length, the steering knuckle goes to the special centering machine shown in Fig. 1, where it is clamped at each end, and both ends are center-drilled and reamed at one operation. The machine requires very little explanation, both heads being driven by a single shaft from the motor at the left, and the power is transmitted by gearing to the centering spindles at each end. These spindles are fed simultaneously into the work, the centering operating requiring something less than one minute. The steering knuckles are next rough straightened and are then drilled and reamed as in Fig. 2. The knuckles are located by centering screws at each end, and the steering arms are supported at the outer end, as shown. The milling operation, as shown by fixture in Fig. 3, involves a rather unusual layout, as can be seen by studying the details in Fig. 4. The fixture revolves so that one end can be loaded while the cutters are at work on the pieces in the other end. Both ends of the steering-knuckle hub are milled by the side cutters at *A*, while the four cutters in the next group mill the four surfaces of yoke forging that fits on the end of the front axle. Both of these operations are shown clearly in Fig. 4, at *A* and *B*. Mounted on the other spindle of the milling machine are two additional cutters shown at *C*, Fig. 4, but which do not appear in Fig. 3, being hidden by the fixture itself. These cutters slit the steering knuckle so that it can be clamped to the king or steering pin, and at the same time the second cutter mills the surface for the head of the clamping bolt. A clearance slot in the pin on which the steering knuckle is located, permits the slitting saw to be fed in to sufficient depth to slit the knuckle on this side. The layout at the right of

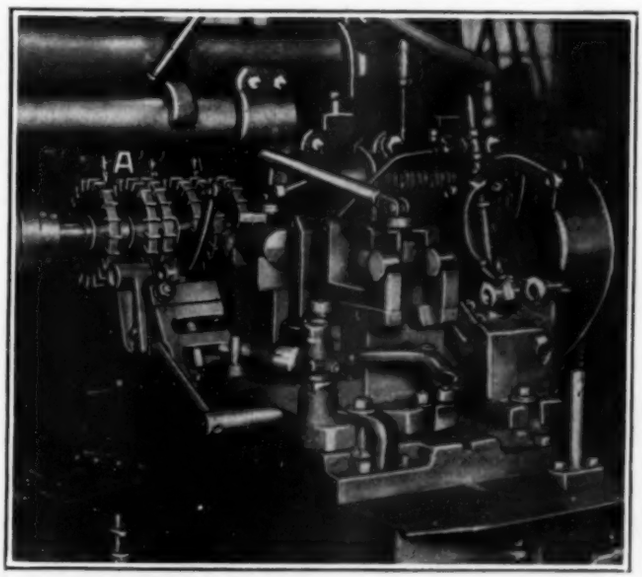


Fig. 3—Milling steering knuckles and axle yoke. This fixture enables a single gang of cutters to machine several mating surfaces of two parts at one operation

Automotive Production

Fig. 4 gives an outline of the cutters and their relative positions. The grinding and threading operations are not shown. It may be stated, however, that the threaded end is first cut 0.003 in. oversize so as to alllow for rethreading before the knuckle goes to assembly. This fixture and cutter layout is a very good example of the way in which a shop with a limited production can utilize standard machine tools to great advantage. With this type of a fixture, carefully designed so as to hold and machine several pieces at the same time and with the same cutters, the standard machine approaches for the moment the usefulness of a single purpose machine built for this particular job. By utilizing an outer support for the main arbor, the cutters driven by the main spindle are held against undue spring when entering the cut, and all six cutters are at work on the various surfaces of the steering-axle stub and the yoke forging that receives it, after it has been assembled in place on the end of its tubular axle.

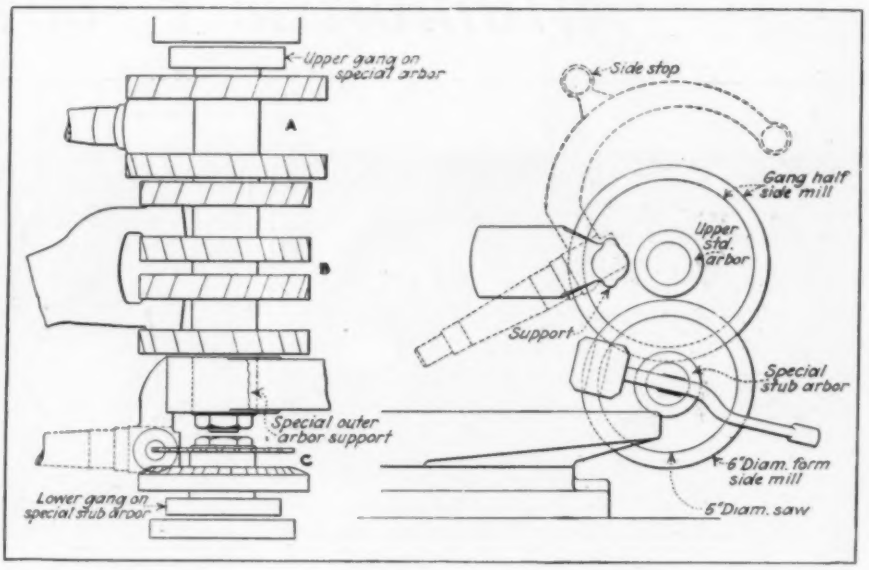


Fig. 4 — Details of the milling fixture shown in Fig. 3. This illustration shows how the various pieces of work are held and how the milling cutters reach the desired surfaces without intereference. A study of the details will make the operation of the cutters clear

It is also of interest to note the addition of another operation, not entirely because of its saving in time but because it synchronizes the output of parts that are needed in the sub-assembly department at the same time. By utilizing the second spindle of the machine to drive a stub-arbor, and mounting two cutters on this arbor, an entirely separate operation is secured at the same setting and at the same pass of the cutters.

These operations complete two units that go together in the sub-assembly and that are necessary for the complete unit to go to the final assembly. By machining them at the same time there is an assurance that both parts have been completed and that there will be no shortage when the parts are to be put together. This assurance of having the required number of parts to complete the assembly of units, or of whole machines, is a point that is well worth careful consideration in laying out machine operations. In Fig. 5 are shown the methods and apparatus used in checking the relative positions of the different connections on the left steering knuckle. The inspection plate at the left shows how these points are checked. At the right is a hand-operated hydraulic press, by which the steering arm can be bent to the desired position so as to secure proper alignment. Other dies for bending are shown at the left of the press.

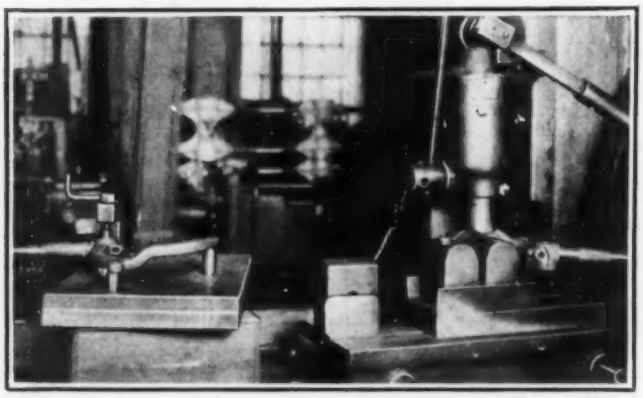


Fig. 5—Inspecting and straightening steering arms. The fixture at the left holds the steering arm in its normal position and shows whether the connections for the drag link and the cross link are in the proper positions. Should any adjustment be necessary, the hand-operated hydraulic press at the right enables any desired bend to be easily made. The various bending blocks shown make it easy to correct the arms of either steering knuckle

Another View of Replacement
Discussion

By A. F. Arand

THE idea expressed in the editorial on page 362, Vol. 67, of the *American Machinist* is confirmed by my own experience as toolmaker and tool keeper in a small shop. I recall one instance where I had made a 1¼-in. reamer which was not a particularly good looking specimen, although it was as accurate as conditions demanded. Later I made another 1¼-in. reamer, taking a great deal of pains with its appearance. A short time after both tools had been placed in the rack, one of the men who used these tools came to me with the good looking one, asking for the other, stating that he was just starting on a hard casting, and that if he had to spoil a reamer he would rather spoil the one that did not look so good.

The man was typical of the average machinist. He did not bring the reamer back because he was trying to save the company money. He just hated to spoil the looks of the tool when he could use another that, to his eye, did not amount to as much. This incident is only one that illustrates the effect of clean and new equipment. On the strength of these incidents, I take pains to give the tools I make the best appearance possible.

Automotive Production

Photographs by courtesy of the Stinson Aircraft Corporation, Detroit, Mich.

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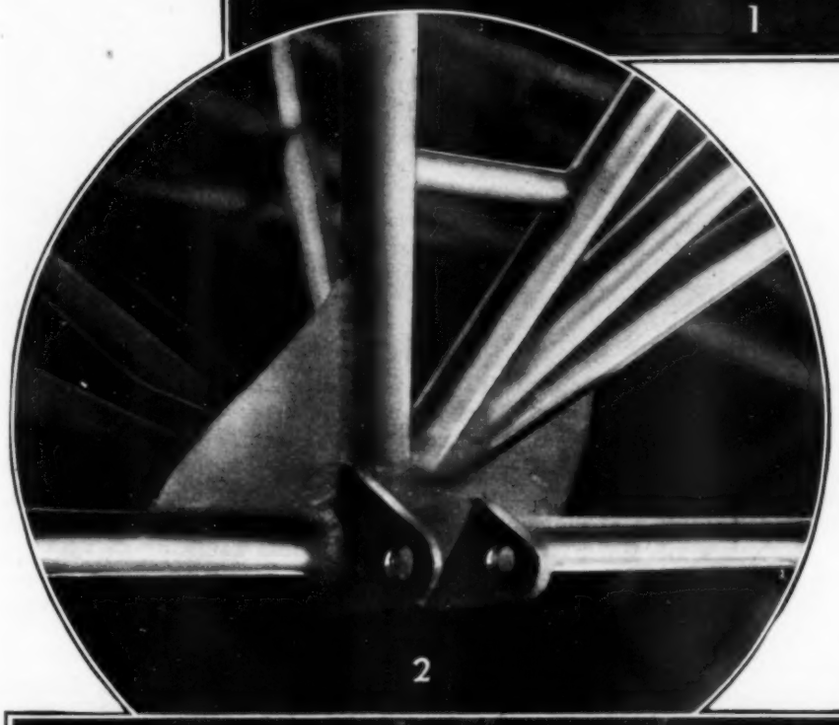

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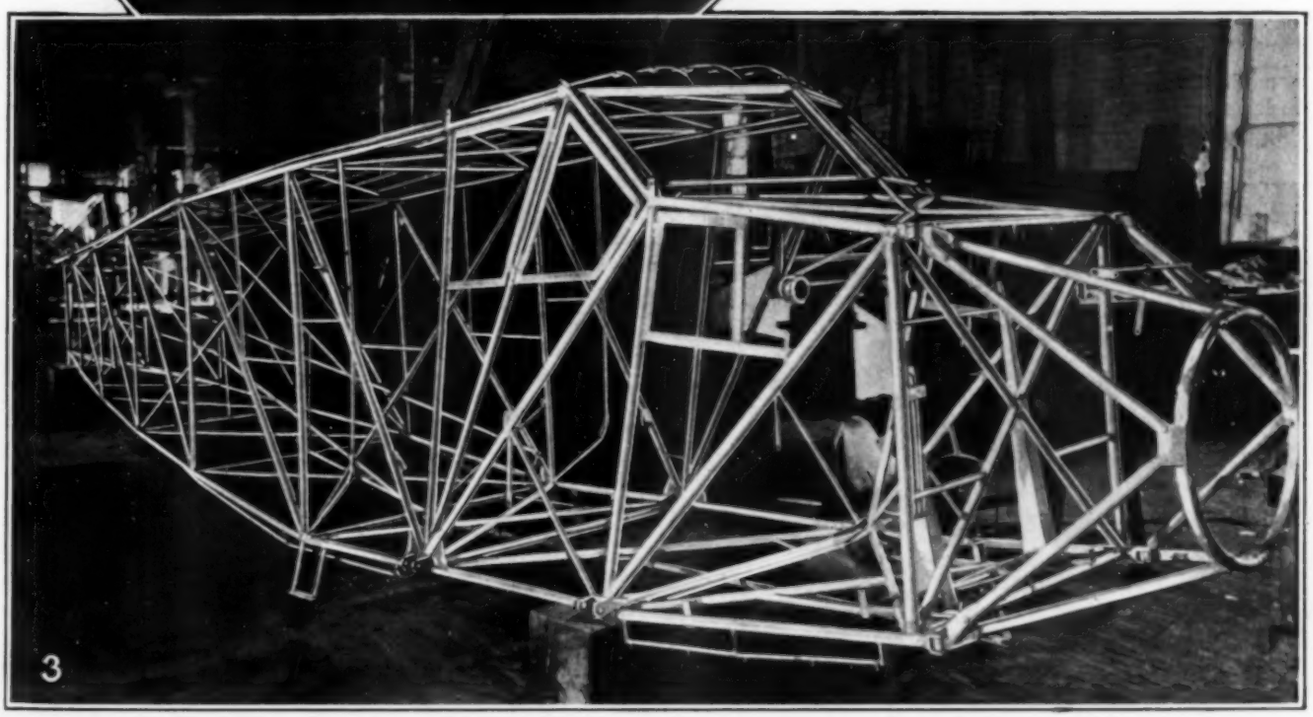
Framework of the Stinson "Detroiter"

1—Stinson "Detroiter" full-cabin plane for four passengers—heated, engine self starter, brakes on landing wheels. 2—One of the complicated joints of steel tubing. Wing ribs are of duralumin, stamped, and without rivets. 3—Complete fuselage showing bracing, wind shield and removable engine support in front.



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Book Reviews

BUSINESS CYCLES: THE PROBLEM AND ITS SETTING. By Wesley C. Mitchell, director of research, National Bureau of Economic Research, New York. Five hundred and twelve 6x9½-in. pages, cloth covers. Published by the National Bureau of Economic Research, 474 West 24th St., New York. Price $6.50.

THE word has been passed around that the "business cycle" has been abolished. Some go so far as to declare the "business cycle" to be a myth. What are the facts? The answer to this question is suggested by Dr. Mitchell. The logical arrangement of the subject matter and Dr. Mitchell's lucid text, make it a delight to read. The author's mastery of English brings the most difficult scientific passages within the comprehension of even the non-technical reader. The book is carefully indexed and is illustrated with numerous tables and charts.

The volume is divided into five divisions. The first is a collection of theories on the subject of commercial crises and depressions; the second division is a description of our present economic organization constituting in itself a short course in economics. The third division traces the development of the statistical approach to the study of business cycles and contains a most valuable critique of business indexes. The fourth division shows the contribution of business annals to the study of business cycles; and the fifth division presents a working concept of business cycles and a concise definition.

CONDENSED CATALOGS OF MECHANICAL EQUIPMENT. Published annually by the American Society of Mechanical Engineers, New York. One thousand and six pages, 8½x11¼ in. Price $5.00.

THE seventeenth annual volume of mechanical equipment shows an increase of 70 pages of catalog data, with a total of 708, representing 562 firms. There are 4,400 firms listed in the directory and 6,100 classifications of equipment, while 500 engineers are listed in the service directory. There are ten sections devoted to power plant equipment; testing, measuring and recording apparatus; power transmission machinery; conveying, hoisting and transporting machinery; metals, alloys and other materials; foundry, rolling mill and forge equipment; metal-working machinery; compressors, blowers and pumps; heating, ventilating and refrigeration; and miscellaneous industrial machinery. The book is bound in limp artificial leather and is easily handled for a volume of its size.

COMMERCE YEARBOOK, 1926. VOL. I—UNITED STATES. Six hundred seventy-six pages, 6x9 in., heavy cloth board covers. Indexed. Compiled by the Bureau of Foreign and Domestic Commerce, Washington, D. C., and sold by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price $1.

THE fifth issue of the Commerce Yearbook appears for the first time in two volumes, volume one incorporating the statistical information pertaining to the United States. The subdivision of the original yearbook has permitted a large increase in its scope, and it contains much information originally collected by trade associations and trade journals in addition to the official statistics collected by the various government bureaus.

The volume contains 17 sub-divisions with numerous tables and charts, each sub-division containing separate monographs on the various subjects treated. The whole is very comprehensive, and the vast amount of material is so arranged as to be easily accessible for quick reference. Some of the subjects covered are: Manufacturing, production, employment, raw materials, wholesale and retail prices, foreign trade, agricultural products, fuels and power, construction, transportation, banking, and finance. The book is an encyclopedia of data on the latest progress in all phases of commerce and industry, and makes a most valuable addition to the library of any executive.

COMPARISON OF AMERICAN, BRITISH AND GERMAN STANDARDS FOR METAL FITS. A technical paper by Irvin H. Fullmer, of the Bureau of Standards, and published by the Government Printing Office, Washington, D. C. It points out that the American standard not only involves the standardization of tolerances on shafts and holes for various classes of fits, but is also a simplification of practice, based on the needs of modern quantity production. The features of this system make for the greatest economy in production. It is based on unilateral tolerances for both shaft and hole, with the minimum hole the basic size.

The British system uses both unilateral and bilateral tolerances however, on both shafts and holes, although it recommends the unilateral system. The German system has two complete standards, one based on the hole and the other on the shaft, but uses only unilateral tolerances.

This pamphlet shows in detail the difference between the systems and should be in the hands of all who are interested in knowing just what is being done in this line. A study of this pamphlet cannot fail to show the advantage of the American system.

KINEMATICS OF GEROTORS. By Myran F. Hill. Second edition. Forty-four pages, 6x9 in. Cloth boards. Illustrated. Published by the Peter Reilly Co., 133 N. 13th St., Philadelphia, Pa. An exposition of the merits of the rotary principle of pumping fluids is first given, and certain conditions that must be fulfilled for successful operation are laid down. The author then proceeds to analyze the work of previous investigators—Cooley, Lilly and Feuerheerd—their patents and limitations of manufacture. With this introduction, he briefly explains his own mutually-generative rotors or "Gerotors" as first conceived. In perfecting his curves, he opened up a "whole field of geometry heretofore unexplored." The three general types of curves developed are discussed under these headings: hypocircroid, epicircroid and oval divisions. The booklet should be of interest to designing engineers or mathematicians.

Erratum

In the review of "Exports, Imports and Concessions of the Soviet Union," on page 258, it was stated that the book is published and circulated by the Amtorg Trading Corporation. The volume is published by the State Trading Import and Export Office, Gostorg, R.S.F.S.R., and circulated by the General Representative of Gostorg RSFSR in America, 165 Broadway, New York City.

A Modern Machine Tool Plant

(Photographs by courtesy of Cincinnati Grinders Incorporated)

The engineering department, Fig. 1, is housed in a clean, well-lighted room, and is equipped with universal drafting machines and the most modern equipment. The department determines the design and specifications of the product, and also interprets the orders received from the sales department. Another function of the department is experimental and research work, some of the staff being designated for this work. A special experimental and research laboratory, Fig. 2, is maintained, where new fields of application of the product are investigated, methods are tried out, and tests of the machines are made

The sales engineering department, Fig. 3, keeps in close contact with the industries served by the plant, and interprets their engineering needs in terms of company product. In the machine shop, Fig. 4, the floors are laid out with central aisles to provide for interdepartmental transportation by electric trucks. The artificial illumination is on the general-lighting scheme plan, with a supplementary scheme on all of the balconies to give equal intensity of illumination to that on the main floor. The interior of the shops is painted with aluminum paint. A saw-tooth roof construction for northern light is used. Almost continuous window space gives ample light, and the high roof assures airiness

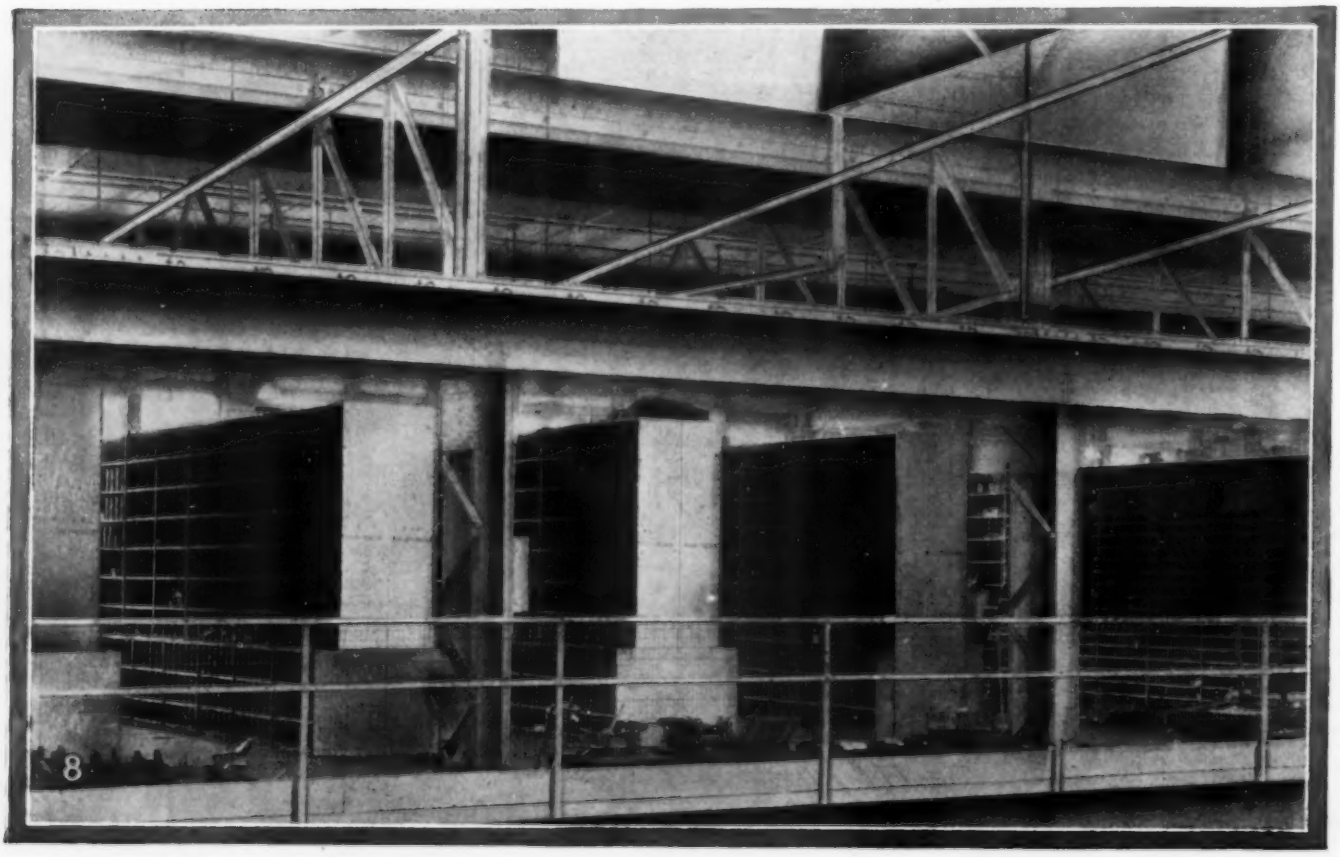
3

4

The unit assembly department, Fig. 5, is located on one of the balconies near an elevator, and in the production line. Adequate traveling cranes are provided. Erecting of heavy machines, Fig. 6, is done on the main floor where the two large cranes can be used for handling. These cranes are of 60-ft. span, each of 15-ton capacity, and equipped with a 3-ton auxiliary hook for the rapid handling of light work

Good tooling facilities are considered important, and two tool cribs, as illustrated in Fig. 7, are provided, one on the main floor and one on a balcony. Besides storage space each crib contains the machines necessary for grinding the tools

On one of the balconies near an elevator is located the stock room for small parts, Fig. 8. Finished parts are kept in the bins and on the shelves. Another part of the balcony is devoted to the storage of larger parts and assembled units



Machining and Measuring Gear Teeth

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Skill and technique of the operator is essential for the successful grinding of gears, in addition to accuracy in the machine itself—Types of gear grinding equipment

THE introduction of each new or improved method of finishing the profiles of gear teeth seems to be hailed as the means of eliminating all future gear troubles. When this hope is not fulfilled, a counter-reaction takes place. This seems to be particularly true of the grinding processes for gear teeth. The fault, however, is not entirely that of the process. Gear tooth grinding is a comparatively recent development and unquestionably needs still further development before it will become a general production process. The larger part of this further improvement, however, is in the development of the skill and technique of the operators in charge of such grinding equipment rather than in radical changes in the design of the tooth grinding equipment. This skill and technique is not necessarily required of each individual operator, but someone in immediate charge of such grinding must have it to secure satisfactory and consistent results.

The grinding of gear teeth is an entirely different problem from that of any of the other production methods. For example, with milling, hobbing, and shaping, there are three primary factors that control the accuracy of the product; namely, the machine, the cutting tools, and the skill of the operator. In all of these processes, the larger part of the real gear skill and technique goes into the production of the cutting tools. The larger part of the recent improvements in all of these processes have been improvements in the accuracy of these cutting tools. The accuracy of the product produced by the gear tooth grinding process, however, depends upon but two primary factors; namely, the accuracy of the grinding machine and the skill and technique of its operator. There is no small-tool manufacturer here to take the brunt of building into the cutting tools the skill and technique required in the production of accurate gear teeth.

In addition, the general trend of production methods today is toward the development of manufacturing processes that require a minimum of skill on the part of the operators. Under these circumstances it should be evident why the first attempts to grind gears on a production basis generally have not been entirely satisfactory.

The grinding of gear teeth is a valuable and necessary process. Its use will become more and more general as its value proves itself. But this can only be accomplished by facing the fact frankly that this is one production process where skill and technique cannot be eliminated from the production floor. Possibly the final solution will be the growth of more gear grinding plants that will specialize on this process only.

Some method of finishing the tooth profiles of hardened steel gears is very necessary. Wherever maximum strength with minimum weight is required, hardened steel parts are used. This has led to the use of hardened steel gears in automobiles, airplanes, machine tools, etc. Gear tooth profiles are very sensitive surfaces, and even small distortions cause much trouble. Such errors not only cause noisy operation but also reduce the load-carrying capacity of the gear teeth. The additional load caused by errors in gear tooth profiles seems to be directly proportional to the extent of the error. Any increase in the accuracy of the tooth profiles of hardened steel gears has, therefore, a very real value. The higher the pitch-line velocities of such gears, the greater this value will be. Today, hardened and ground spur gears are being successfully operated at pitch-line velocities of 16,000 ft. per minute. Practically all ground gears as finished have a very high-pitch tone when operated under load at relatively high speeds quite different from the tone of cut gears. This tone is caused by the fine grain of the ground surfaces, which

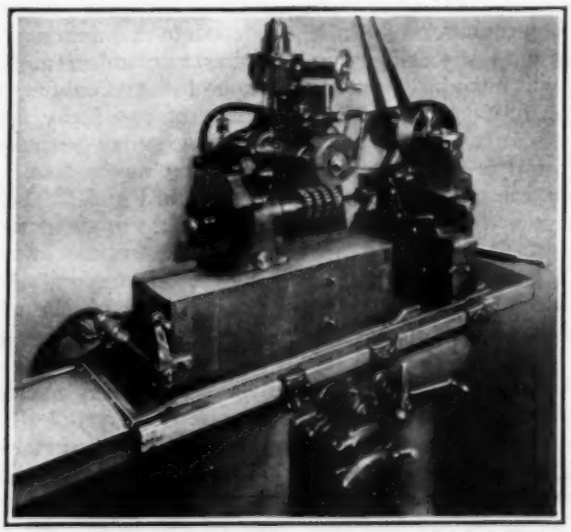
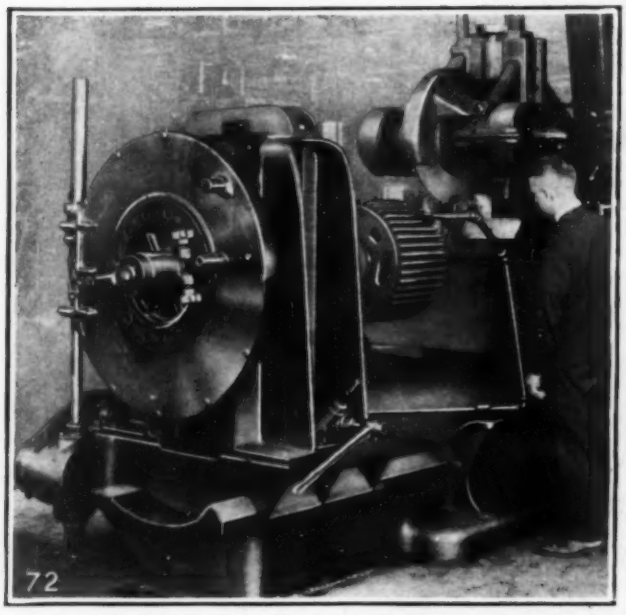


Fig. 71—Small form-wheel type of production gear grinder

The twelfth article. The thirteenth and final article will appear in an early issue.



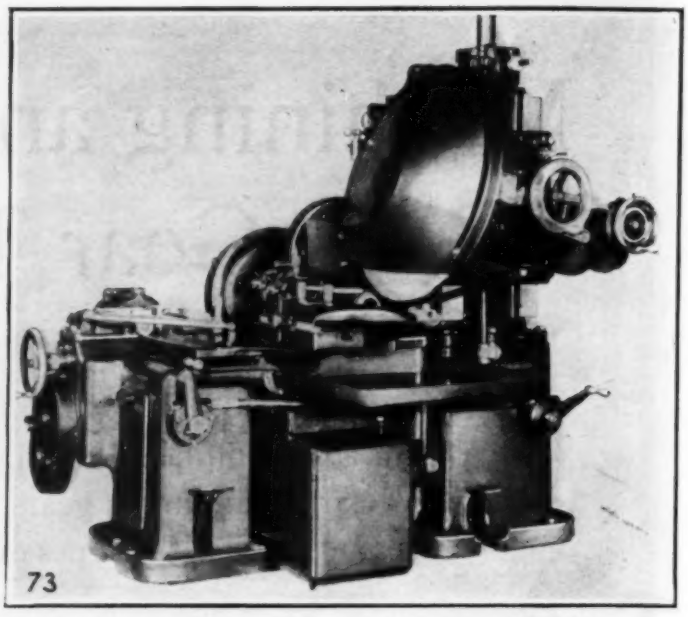


Fig. 72—Large size gear grinder of the form-wheel type. Fig. 73—Lees-Bradner generating type of grinder

are never absolutely smooth. If these grinding marks are not too deep, this surface soon wears or polishes to a very smooth one, and the amount of this sound is reduced until it practically disappears. In many cases, this difference in the character of the sound of ground gears has been responsible for their condemnation, primarily because it has been different from the usual sound of cut gears. In order to judge the smoothness of operation of ground gears by ear, it is necessary to listen through this high pitched tone for the other characteristic sounds caused by faulty tooth profiles, spacing and the like.

One troublesome source of error on almost all gear tooth grinding machines is the wear on the grinding wheel. This introduces the problem of selecting the most suitable grade and grain for such grinding wheels. If the wheel is hard, it will hold its form longer but cannot grind as fast because of its tendency to glaze. If the wheel is soft, it will cut more freely but will lose its form sooner. This holds true on all types of gear tooth grinding machines. The final answer here, as in practically all other production problems, is a compromise between these conflicting elements. A suitable grinding wheel must be selected to meet the particular conditions that exist with each different type of material to be ground.

If the teeth of the gear are ground successively in order, wear on the grinding wheel will introduce a maximum cumulative error between the first and last tooth space ground. This maximum cumulative error may be greatly reduced by using a suitable multiple-tooth indexing arrangement. Thus instead of indexing one tooth interval at a time, a multiple-tooth indexing interval may be selected such that the first and last tooth ground are never adjacent. For example, if a gear with 20 teeth is to be ground, and the gear is indexed 9 tooth intervals each time, the tooth spaces would be ground in the follow order: 1, 10, 19, 8, 17, 6, 15, 4, 13, 2, 11, 20, 9, 18, 7, 16, 5, 14, 3, 12, and then the same cycle would be repeated again if two cuts were taken. In this way the effects of wear on the grinding wheel are distributed around the circumference of the gear and do not result in a large cumulative error between adjacent teeth.

Gear tooth grinding machines may be divided into two general classes: first, those that use a formed wheel, and second, those that use a grinding wheel, the form of which represents the basic rack of the gear tooth system, in combination with a molding or generating action.

In principle, the formed-wheel grinding process is very similar to the form-milling process, with the substitution of a formed grinding wheel for the milling cutter. This process, developed by the Gear Grinding Machine Co., of Detroit, was among the first gear grinding processes successfully used in production. In Fig. 71, a machine of this type, of the size used to grind gears for automobile transmissions, is shown.

In operation, the grinding wheel is trued in position by a truing device located at the end of the work table. The operation of this truing device is controlled by accurate templates of enlarged form. The grinding wheel is finish trimmed immediately before the finish grinding of each set-up of the gears in the machine to insure accuracy of the final cut.

The truing device must be accurately located in relation to the position of the gear blank in order that the tooth profiles be correctly positioned. When once this position has been secured, no further change is required as long as similar gears are to be produced.

The functional elements of this machine have been reduced to a minimum, consisting primarily of an indexing mechanism and a formed wheel with suitable means for maintaining the form on the wheel. Gear tooth profiles of any desired form can be produced by providing suitable templates to control the operation of the truing mechanism. A larger machine of this type is shown in Fig. 72. This machine has a capacity of pitch diameters up to about 50 in. and face widths up to about 21 inches.

There are several designs of gear tooth grinding machines now on the market that employ a generating of molding action with a flat-faced grinding wheel. All of them employ the same fundamental principles. The earliest successful and commercial machine of this type was one developed by the Fellows Gear Shaper Co. to grind the relieved surfaces of their pinion-shaped cutters.

Practically all machines of this type employ a flat-faced grinding wheel tipped at an angle to represent the side of the basic rack tooth of the gear tooth system. In order to generate the involute gear tooth profile the gear blank is rolled past this grinding wheel with the

same rolling motion as when an accurate gear is meshing with its basic rack. An index plate is usually employed to index the blank so as to grind the successive tooth profiles. Here, as with formed wheel grinding, a multiple-tooth indexing arrangement could be used to advantage to prevent the first and last tooth ground from being adjacent.

One design of this type of gear tooth grinding machine is the Lees-Bradner machine illustrated in Fig. 73. This machine uses a single grinding wheel and grinds one side of the tooth profiles at each set-up.

The rolling motion on this machine is controlled by a pitch disk of the same diameter as the pitch diameter of the gear to be ground. To this pitch disk are attached two thin flexible steel tapes, as shown in the diagram in Fig. 74, which are attached at their opposite ends to the bed of the machine and stretched tightly, thus causing the work spindle to rotate without lost motion or slippage as the carriage of the machine is moved from side to side under the grinding wheel.

As noted before, if an involute gear has perfect tooth profiles perfectly spaced, no modification of the involute tooth profile is necessary. As errors of even very small amounts often cause noise in operation, particularly if edge contact exists at the beginning of mesh, a very slight modification often proves advisable to compensate for other small errors. On grinding machines of this type, such modification to avoid edge contact at the beginning of mesh may be obtained in one of two ways: First, the normal pitch of the driving gear may be made slightly

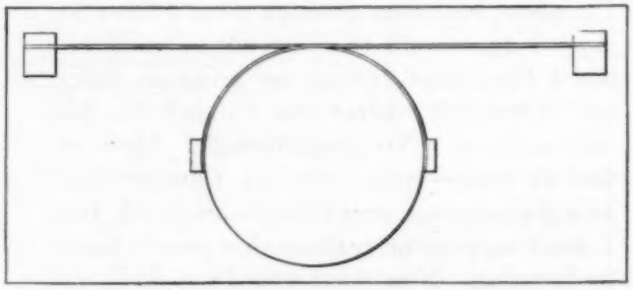


Fig. 74—Pitch disk of the Lees-Bradner gear grinder

larger than that of the driven gear, by changing the angle of the grinding wheel. If this angle (pressure angle) is made smaller, the normal pitch will be increased: If it is made larger, the normal pitch will be decreased. The second method is to set the pitch disk to which the tapes are attached slightly eccentric or off center with the work spindle in a vertical direction. The amount of such modification required depends primarily upon the accuracy of the other elements of the machine and must be established by trial. Furthermore, such modifications should always be kept to an extremely small amount. Gears whose other elements are so inaccurate that they require excessive modification to compensate for these errors, can never be fully satisfactory.

The flat-faced grinding wheels used on these machines are trued by a diamond dressing tool mounted in an arm that swings in a plane perpendicular to the axis of the grinding wheel. This diamond truing device is set in a fixed position so that the grinding wheel is fed into it for redressing, thus maintaining the grinding face of the wheel in a fixed position.

An earlier design of this same type of grinding machine was developed by the Brown-Lipe Co., of Syracuse, N. Y.

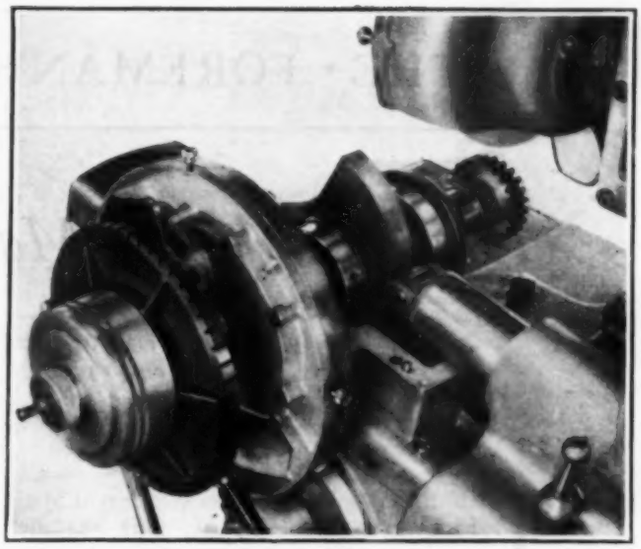


Fig. 75—Cam control of profile on National gear grinder

This machine used two grinding wheels, thus finishing both sides of the gear tooth profile in the same operation. The work spindle is also in a vertical position in front of the grinding wheels. The grinding wheels on these machines are very large, about 5 ft. in diameter, and are constructed of small segments fastened to a large cast-iron disk. The principle of operation is the same as for the previous machine described.

The Fellows Gear Shaper Co. has also developed a gear tooth grinding machine for automotive gears. These machines have but a single grinding wheel but they are so designed that two or more units may be mounted on a single base, some to grind one side of the tooth profiles while the others grind the opposite tooth profiles. Instead of using a pitch disk and tapes to control the rolling motion of the work spindle, these machines have cams of involute form acting against straightedges that have angular adjustment. These straightedges represent the side of a tooth of a basic rack.

Another machine of this same general type is one developed by the National Tool Co. of Cleveland, Ohio. In Fig. 75, the cam type of control is clearly shown.

A Peculiar Chip

By W. Burr Bennett

THE chip shown in the illustration was made in drilling a hole in a block of rubber. The drill was ground to the conventional angle and clearance, and was

Chip from a block of rubber

run at the same speed as when drilling malleable iron. No lubricant was used.

The rubber is used to support the radiator on the frame of a 3-ton truck, and is about the same as that used on the treads of solid truck tires.

THE · FOREMAN'S · ROUND · TABLE

How Handle the Man Who Can't Listen?

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"I HAVE a problem, Al, that has me worried. Would you like to give me the benefit of your sage advice?" So spoke Ed to his fellow foreman as they waited for the local that would bear them to their day's work.

"What's on your mind, Ed? Shoot."

"Brennan has caused no end of trouble. Left out the oil holes on those special links."

"Wasn't he working to —"

"Yes, everything except the oil holes was shown on the print. Brown phoned me yesterday just as I was leaving the office for our conference with Williams. Told me he had just discovered the omission, wanted to catch us before it was too late, and would send confirming instructions. I went down and told Brennan, but he had something else on his mind that he wanted to talk to me about, and I really believe he didn't understand a word I said. At any rate Brown's truck was at the door when the links came off the boring machine and Brennan loaded them on, because Brown was held up on a big job until he got them. Then another day was lost on account of the oil holes."

"But I thought Brennan was one of your high-class men, Ed."

"He is, but he can't listen. When anyone is talking to him his mind is always racing ahead figuring out what he is going to say—and what he says is generally entirely off the subject or at any rate not strictly to the point. I never know whether he understands instructions or not. He's so anxious to talk that I now expect him to interrupt me just when I'm about half way through what I have to say. I don't want to shout my instructions, but I have kept raising my voice at times until I made it evident that I didn't like his interruptions. No good though. He's as bad as ever—apparently the thought that he's discourteous never enters his mind, and I don't suppose he realizes that people learn by listening. Now what would you do?"

"Ed, I generally qualify my answers to your questions, but this time I won't. I'd tell him *once* in no uncertain terms all about it. If that didn't cure him, I'd take the necessary steps for a blue ticket for Mr. Brennan. It's my opinion that a man who can't listen can't shoulder responsibility."

How do you analyze the character of the man who can't listen?

Isn't it a fact that the "can't-listen" type makes frequent errors, and then can't remember having had instructions?

Was Al right or wrong in taking such a decided stand? Would getting fired for his fault cure Brennan?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Keeping Track of Improvements

ONE day, during the war-time rush, our chief inspector grabbed the chief engineer on the run and said: "Say, it's hard to run the threads right up to the shoulder on these studs. Can't we undercut the thread a little at the shoulder?" "Why, I guess so, I'll ask the government inspector," said the chief engineer, as he hurried on and promptly forgot all about it. The next batch of studs came through undercut, with the blue-print for the job marked in pencil, "Undercut at shoulder," and were passed by our inspector. A week later, a big shipment of finished machines was rejected by the government inspector because of these studs. The general manager and the superintendent took one look at the studs, gave a good loud laugh at the chief inspector's story, and fired him on the spot. Of course, he should not have passed those studs. Sure! he should have had the blue-print O.K.'d. But wasn't it partly the management's fault for not having a better system for putting through changes in design? A good many blue-prints were drifting around that shop with changes scribbled on them in crayon or pencil. If the general manager had thought it over, wouldn't he have seen that the inspector was being made the "goat" for the engineering department's lack of system? And wouldn't the inspector, having learned his lesson, be worth more to the company in the future, than the new green man who was taken on in his place?

—CHAS. S. HAZARD.

THE first step in bringing to attention ideas for improvement in the product, is to get them down in writing. The death knell of many good ideas is sounded when someone tells about an idea to someone who promises to look into it, and in the rush of current detail proceeds to forget all about it. The man who conceives the idea should put in on paper.

This written description should be addressed to whatever source of highest authority that will finally pass on it, but routed definitely via the foreman and shop superintendent. They in turn will have to look into the idea before indorsing it, and so will either show the man who originated it that it is not feasible, or pass it on. With the shop superintendent's indorsement, it must receive the attention of the chief engineer. He will naturally pass it on to a subordinate for a detailed investigation, and since that subordinate has received it from his chief, he will be obligated to render a report on it, and since the entire transaction is written, he will state his objections or recommendations for action likewise.

Thus, by putting it in writing at its inception, it gets the backing immediately of all those who indorse it, and the full weight of their authority and prestige. Many a good idea, which is otherwise lost because the originator is not capable of selling it verbally, is thus saved to bear fruit in the company's product.

—JOHN L. STARR.

Insurance and Savings in the Shop

THERE is inclined to be too much "keeping up with the Joneses" amongst workmen, and no one is in a better position than the shop foreman to exert the proper influence toward a more rational basis of living on the part of the workmen. The foreman, after all, directly influences more hours of activity of the individual workman than any other person outside of the man's immediate family. If the workman lives from hand to mouth, he is not doing justice to himself, his family or his company. He is literally "passing the buck" on his own responsibility, with the carefree thought that somehow he'll muddle through, and if not, his friends in the company, or the company itself, will help him out in a pinch. This method is not fair all around, and, in fact, if he stops to think, he will realize that he is the worst victim of his own thoughtlessness. To make him stop to think in this, as well as in strictly company matters, is a very logical function of the foreman. Therefore, for the company to organize thrift on a business basis was but a logical step to take advantage of the greater possibilities of co-operative bargaining. In the same way as production or mass methods means a better product at a lower cost in the shop, so production protection, or "group insurance," means more production at a lesser unit cost to the individual workman. The company, on the other hand, does away with the uncertain, haphazard contribution, and is able to budget its own aid to the men.

—JAMES F. FITZGERALD.

TEACH the young man thrift and he acquires a habit that will be an asset to him the rest of his life. Show him how easy it is to save by systematically putting away a small sum every week, and he will soon be on the way to a life of comfort and ease. An apprentice is in the same category as a student, and if he learns other useful habits as well as his trade, so much to his credit, regardless of who teaches it.

Who is it that is the bulwark of the community? Who is the dependable man in shop? Who gets in on time, and very seldom takes a day off? That man is generally considered tight, but only by those of the opposite class, who never have any money left from one end of

THE · NEXT · TOPIC

Posting Too Many Rules

ADVANCE QUESTION

Al and Ed have a discussion as to rules and regulations. Ed likes to see a long list posted near the bulletin board. Al thinks it better to post very few rules, and have the foreman tell the men personally. How about it?

the week to the other, and are always broke, their pay spent before they get it. Truly, he is the more desirable man. —P. H. PEARSON.

AT THE plant where I am employed, a dollar a month is deducted from each man's pay and is used to maintain a dispensary, with two doctors and two nurses always in attendance. Any employee who takes sick or is injured, even out of working hours, is paid $10 a week after the first week of disability, and upon the death of employee his family receives $100. The company handles the money, and also has the doctors examine the patients regularly.

We are urged to save money by an employees' stock ownership plan. Each man is allowed to buy stock according to the amount he is paid. These stocks may be paid in cash or at the rate of $4 per share deducted each pay day. —WARREN J. GREEN.

Abolishing Private "Mikes"

A GOOD mechanic takes pride in his tools, and if you question their accuracy you question his ability. It seems unbelievable that any man would allow his micrometers to wear to such an extent that they were 0.002 in. out. The company should furnish micrometers over 2 in., and should also maintain standards for checking smaller sizes. —P. H. PEARSON.

THE discussion on private "mikes" checks with my own experience some years ago in a shop where each new man was supposed to report equipped with his own micrometers, but if he had none, it was possible to rent them from the company. The rental fee was deducted through the timekeeper's office, and if the rental fee seemed high, the machinist always had the remedy in his own hands by going to his foreman and signing an order, authorizing the purchase of a "mike" for his account. Payment was deducted from ensuing pay checks. The weekly rental deposit was required until the new micrometer was paid for, but all rentals paid from the time an order was placed until delivery was made were credited against the cost of the "mike." Under this plan I acquired four micrometers during the time I was employed in that shop. —ELTON STERRETT.

Saving Money with a New Machine

USUALLY a new machine is regarded as a novelty, or something by which jobs are done by an entirely new method. Little regard is paid either by the foreman or by the operator to the larger output required to justify its existence. By placing a notice on the machine, or informing the foreman verbally of the cost and other details, its larger requirements cannot be ignored. If stress were laid also on the saving of labor to the operator, still greater economies would be effected.

—R. G. HEWITT, *England*.

Learning the Value of Deferred Judgment

AL'S idea of Williams' deferred judgment in the case of Jackson and the spoiled work would probably be the opinion of the majority of thinking people. Many times a job is started, and changes are made in the drawing without notifying the shop. Between the time when the machining is finished and the job inspected, new blueprints are issued, the result being that the machined dimensions are not to the drawing, thus causing the piece to be scrapped. If the responsible person is given a chance to investigate and plead his own cause, justice may be done and responsibilities for failures and spoiled work placed where they belong. —O. W. COOPER.

Receiving the New Man in the Shop

THE courtesy due any stranger is certainly due a new man in the shop for the same reasons that it would be anywhere else. He should be given whatever instructions may be necessary to give him a clear understanding of what is required, which often consists of some shop standards peculiar to the individual shop, in addition to what may be indicated on the drawings. He need not be told every detail that every mechanic should know, and by so doing led to believe that his new employer is suspicious of his ability, but he should be instructed in everyhing where there is any chance of being construed in other than the right way. —JOHN MARK MAY.

I WOULD introduce the new man to very few, if any, of the other men in the shop, unless it was absolutely necessary. But having once set him to work, I would quietly slip around to some of my best and most sociable men and give them his name, a few brief facts about him, and ask them to just take a moment or two and speak to him. The conversation of a moment or two will serve as a far better and less strained ice-breaker than a formal introduction by a third party.

—BEECHER PARKHOUSE, *Canada*.

What Is the Foreman's Job?

WHY would it not be beneficial for a foreman to write the things he is expected to do? He would be analyzing his requirements, and would thus realize how far his duties extend. He would see that he is expected to be a manager of his department, as well as instructor of his men. It would start him thinking.

I believe that Ed would change his mind about it being the manager's job to do all the thinking, after he sat down and reasoned out the problem. The manager does not think out Ed's detail problem. At the same time, the manager is training Ed to think along more advanced lines, probably to take some of the burden from his own shoulders, and allow him to give more time to greater problems. —A. H. VOGEL.

ED's outburst is doubtless the most common and most natural, yet when he starts making the report he will find that he had better improve methods before he writes about them, and he will find that he is quite unfamiliar with various details of his department. An outstanding advantage of such reports is that the management can study them all, and use some of Al's ideas to help Ed, and some of Ed's to help others. These duty layouts will also prevent "passing the buck," because definite lines will be established where there was a doubt. —J. C. P. BODE.

Consulting the Foreman on Tool Design

ABOUT three years ago, in a shop making builders' hardware, it was found necessary to split up a blanking and forming operation because the press was overloaded. Some time later, the engineering department was reorganized, and one of the first steps of the new personnel was to design and have built a new set of tools combining the operations mentioned. When this was done, at a cost of about $2,000, it was naturally found that the job was too much for the press. This meant either purchasing a new press to handle the tools or scrapping the tools. The tools were scrapped. The foreman had been on the job practically all of the time, and was not consulted on the design of the tool. A few minutes' consultation in this case would have saved at least $2,000 for the company. —L. B. JONES, *Foreman.*

Saving Money with a New Machine

ED WAS adopting a short-sighted policy in objecting to the boss informing the men about the returns he expected to get from the new machine. His attitude seemed to discount the thinking capacity of his men in refusing them credit for seeing what the boss expected from his investment. From his own personal point of view, Ed's value would be increased if he could talk intelligently about costs, and not merely look on himself as simply there to get the work out. Incidentally, Al might have mentioned in addition to the points given, the fact that the reduced operating time would result in a saving of overhead charges.

—T. H. HARGRAVE, *England.*

Receiving Personal Mail in the Shop

TOO bad, Ed, that the boys in your shop have to start a "Bolsheviki riot" to get action on a dinky little affair like a mail rack. On the other hand, there are plenty of firms spending good money on so-called "welfare work," instead of finding out some of the little conveniences that the men would like, such as having occasional personal mail delivered to them. It isn't much trouble for the "kid" in the personnel department to look up the man's location in his file, then go to his foreman and say "Letter for Joe." It's up to the foreman whether to give Joe the letter himself or tell the boy to do it; let your foreman be the boss in his own department. Let's make the shop less of a jail; a small expenditure of consideration for the men pays big dividends in loyalty.

—CHAS. S. HAZARD.

IT IS my personal opinion that very few men take advantage of a company by having their personal mail addressed in care of the shop where they are employed. However this occurs at times when friends or relatives send them mail even if their home address is known, for reasons that are evidently personal.

The handling of such mail belonging to employees amounts to so little it is seldom worth while to ever mention it to them. At the plant where the writer is connected all company mail is sorted in the mail department whenever it is delivered to the plant, and is delivered by messenger service to the respective department to which it is addressed, and employees mail comes right along with company mail so that no special service is given to either. Any mail addressed to the employee is distributed in the foreman's work order box as it comes in, so is never delayed more than 3 hours from the time of plant delivery.

This extra service required to handle such mail is small, as the number of pieces handled per day will not average over one piece per 100 employees, and we are glad to accommodate them to even a greater extent than this if they desire it. —J. H. WICKMAN.

Looking Beyond the Department

THE difference between foremen is considerable. Some are engineers, and have been bred in engineering environment. But others, and these are many, have merely graduated into foremanships as a result of general excellence in mechanical work. The first kind of foreman cannot help but look beyond the department. He sees the finished design, and he involuntarily assumes the rôle in his own line as being partly responsible for the product. With such a viewpoint, his path is not the humdrum kind generally associated with the shop foreman's position in some machine shops.

—J. T. TOWLSON, *England.*

Tool Sales in the Shop

IT HAS always been my practice to encourage men in the shop to own a set of small tools of their own. I find that they take good care and a great pride in them, and I always find that they turn out work with greater precision and in less time than the man who is always hunting up tools on requisition from the stores. I favor the idea of the company purchasing them, and letting the men have them at cost price, including, of course, the extra cost due to purchasing.

—C. L. HENRY, *England.*

AN IDEA that worked out well in the plant where I am employed was to give the supervisor of apprentices authority to take orders for tools. The supervisor then tried to sell each apprentice a complete set of tools, so that when the boys finished their time they were completely equipped to go to work. An apprentice may order all the tools that he wants, and a payment is deducted each pay day until the tools are paid for. Any other employee of the plant may place an order for tools in the same way. Besides tools, this purchasing scheme also includes tool boxes, handbooks, or any books relating to the trade. —WARREN J. GREEN.

ENCOURAGING tool purchases is a sensible procedure when a plant produces a high class of work employing the better type of workman. The employee who is early impressed with the importance of proper tools is certain to develop into a more careful and accurate workman. Individual tool possession, incidentally, inspires pride, greater care for the tools, and also a higher regard for workmanship. The man who is indifferent when it comes to the question of tools is not the one who does quality work in the shop.

—FRANK V. FAULHABER.

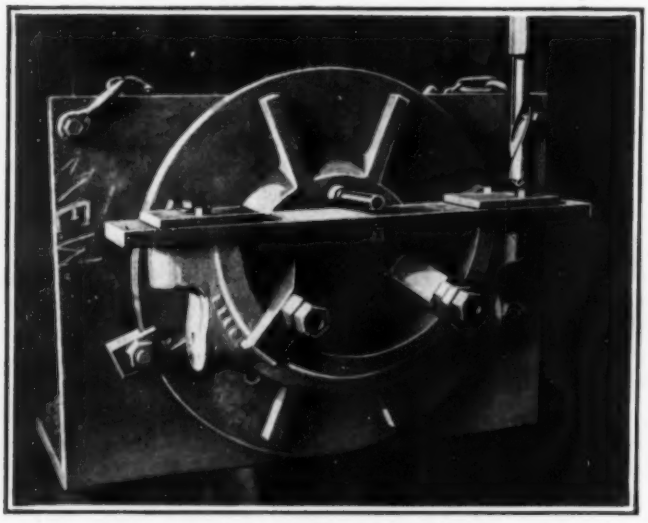
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Jig for Eccentric Straps

By George H. Feltner

The illustration shows a jig for drilling the bolt holes in eccentric straps, so that both halves will be in alignment when assembled. The jig consists of a turntable to which a bushing plate is attached, the bushing plate being at a right angle with the face of the turntable.



Indexing jig for drilling eccentric straps

The jig is mounted on an angle plate attached to the table of a drill press. The halves of each pair of straps are drilled separately.

In operation, one of the strap halves is clamped to the turntable so that its joint face bears against the bushing plate. After the bolt holes have been drilled, the turntable is indexed 90 deg. each way, alternately. At each indexing one of the lubricator holes is drilled. The other halves of the straps are handled in the same way.

Machining Cast-Iron Pads

By J. E. Fenno

The pads, one of which is illustrated in Fig. 1, are machined by the tools shown in Figs. 2, 3 and 4, respectively, and their functioning is as follows:

The first operation is done in a Springfield turret lathe, the work being held in special jaws *A*, Fig. 2, in a standard two-jawed chuck. The overhanging corners of the pad are supported by the setscrews *B*. The work is spotted with a center drill, followed by a drill and reamer.

The toolholder *C* is then brought to the position shown and is moved up to a stop. The turret (which is on the

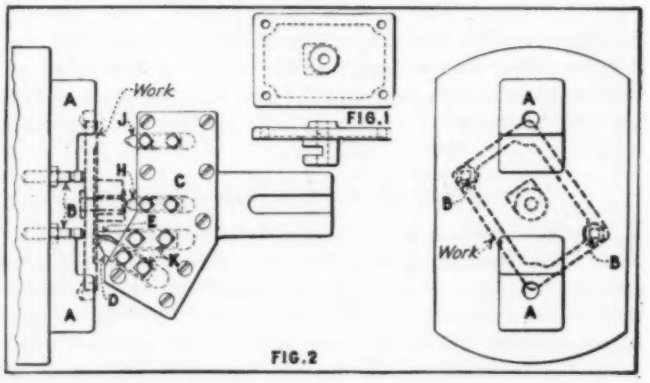


Fig. 1—The pad to be machined. Fig. 2—Tools for facing

cross slide) is then fed toward the operator. The toolbits *D* and *E* perform the roughing and finishing on the flange, while bits *H* and *J* rough and finish the end of the hub. It will be noted that the tool *J*, is inverted to permit it to take the finishing cut on the face of the hub.

Next the slots in the hubs of two pads are milled at one time in the fixtures shown in Fig. 3, in a vertical milling machine, duplicate fixtures being provided. One fixture is keyed to the machine table, while the other one can be adjusted toward the cutter after slacking the holding bolts. This adjustment is necessary, due to the changing diameters of the cutter *A* after each sharpening. The work is loaded in the fixtures, centralized by pins *B* and is held down by the removable block *C*, backed up by the set screws *D*. The slots are completely milled in one cut.

In Fig. 4 is shown a circular station-jig for drilling and tapping the four flange holes on a Natco multiple

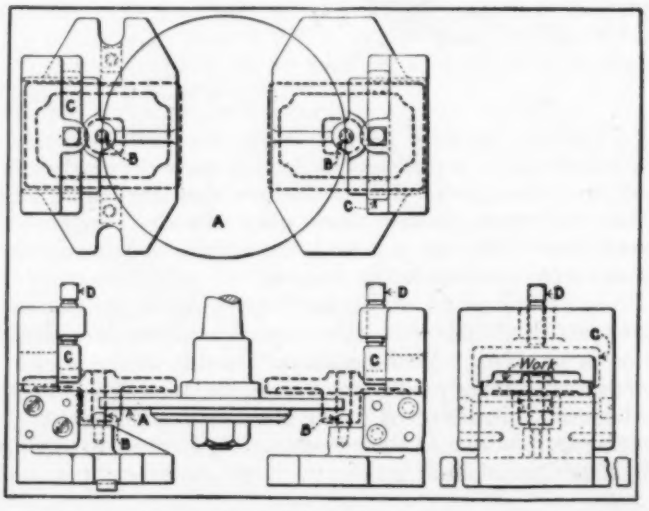


Fig. 3—Fixtures for milling slots in two hubs at once

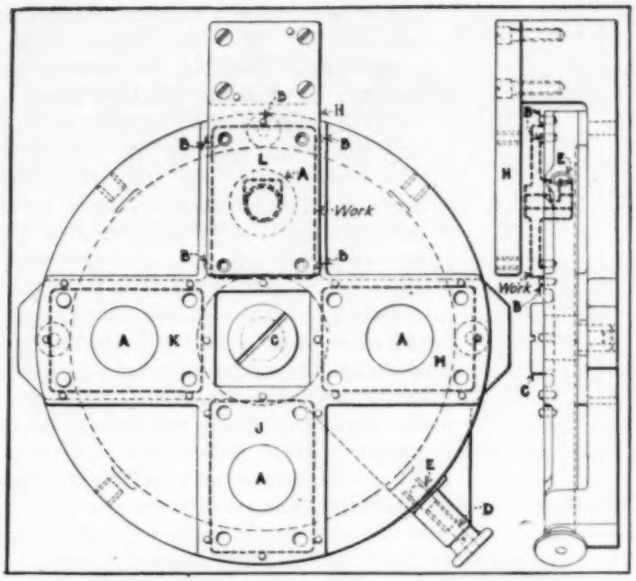


Fig. 4—Indexing fixtures for drilling and tapping

drilling machine. The stations on the revolving table have cored holes *A* provided as clearance for the long hub on each piece of the work.

The work is centralized and located by pins *B* at each of the stations. The circular table revolves about the stud *C* in the base of the jig. The table is indexed by the spring plunger *D* entering the bushings as at *E*.

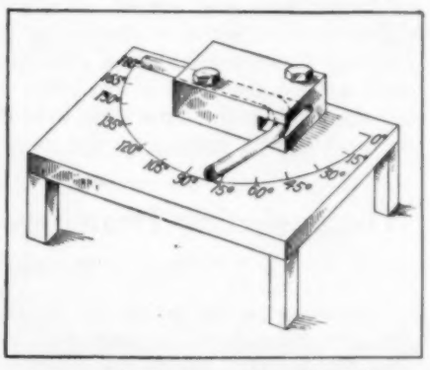
The bushing plate *H* is screwed and doweled to a projection on the base. In operation, the work is loaded on either of the stations *J* or *K*, and for each indexing, one piece is completely drilled at station *L*, being afterward tapped at station *M*, and is removed from the jig at station *J*. Four spindles of the machine are set for drilling at station *L*, while four more spindles are set to tap the four holes at station *L*.

On section *X-Y* is shown the comparative height of the taps in relation to the drills. It will be noticed that while one piece is being drilled at station *L* another is being tapped at *M*, thus permitting a piece to be completed at each cycle.

A Pipe and Tube Bender

By Peter Hagen

A necessity in almost every shop is a quick but efficient and accurate device for bending tubing and piping. Bending machines and radius gages are expensive, and considerable time is lost in setting up such apparatus for a single job. A device for speed and accuracy of pipe bending is shown in the sketch. Bending blocks for different sizes of pipe can be made if desired, or a large block will suffice for bending all pipe of a smaller diameter. The curve in the block permits the pipe being bent to a full 180 deg. The blocks should be attached to the table to keep them stationary when pressure is applied to the pipe for bending. A scale of degrees should be stenciled on the table top to make it easy to find the line of bend for any desired angle. An outfit as pictured will permit bending as fast as the workman may desire, and no guess work will be necessary. For the bending of large pipe it may be necessary to use a long pipe for leverage, and the same will necessarily apply to short pipe of almost any diameter. As in all methods, sand should be used to prevent flattening the pipe at the bend.

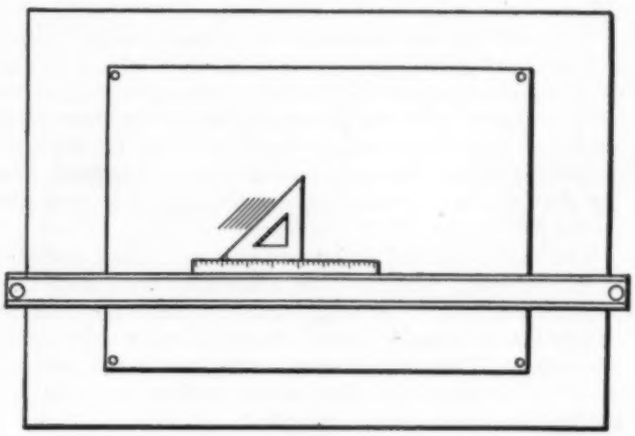


A simple device for bending pipe

Spacer for Section Lining

By Frank D. Smith, Jr.

Uniform spacing of dimension and cross-hatching lines has always been a trying proposition for the draftsman, and especially for the beginner. Many devices have been produced but most of them are more or less complicated and troublesome to set up. The accompanying sketch shows a method of spacing lines with very little expenditure of effort, and requires only the equipment that is always in use on the drafting table. The only change to make in the existing equipment is to scratch a small line near the vertex of each angle on the triangle. This line may be filled with ink if desired, but it will be kept black when in use, by the mere sliding of the triangle over the drawings. Any suitable scale is held against the upper edge of the T-square, or the parallel ruler if one is used, and the triangle is moved until the scratched line registers successively with the markings on the scale. In this manner, lines of any angle may be spaced as accurately as by a machine, and the resulting better appearance, especially in drawings for publication, is well worth any slight additional effort.

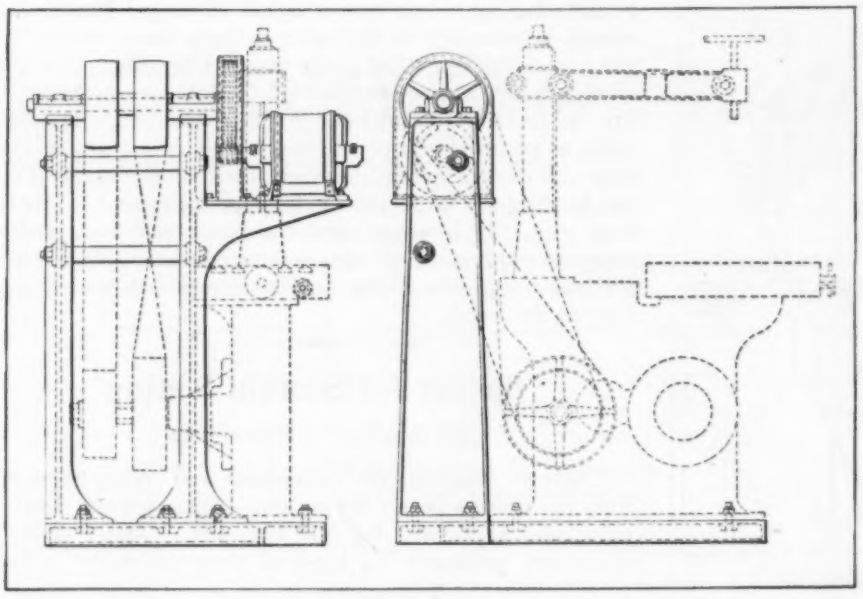


A simple device for spacing

Motorizing a Keyseater

By Wm. C. Landis

A keyseater with two pulleys rotating constantly in opposite directions by an open and a crossed belt, and reversing through the medium of shifting clutches, presents a problem in integral motorization. We motorized a No. 1 Baker keyseater in the manner shown in the accompanying sketch, and a year and a half of thoroughly successful operation has removed any doubt we may have



Motor drive applied to a keyseater

had as to the practicability of running a 4-in. belt crossed on such short centers. With daily operation throughout that period we have never had to shorten or replace either of the belts.

The machine was mounted on a base-casting, raising it 3 in., and giving a more convenient working height. Cast standards about 4½-ft. high, were mounted on the base in such a position as to best support a short jackshaft carrying the driving pulleys. A 3-hp. 1,160 r.p.m., constant-speed motor was mounted on a bracket, driving the jackshaft through a properly guarded gear and pinion.

The motor control is by non-reversing start-and-stop push buttons, making the electrical equipment the simplest possible. The machine and drive present a symmetrical and pleasing appearance and are entirely self-contained. The machine unit with controls is still the same as it came from the factory, without a single part having been removed or modified.

Chattering Milling Machines

By Charles Homewood

When using broad cutters on milling machines, it is the practice of good mechanics to put the cutters on the arbor as near to the main bearing as is possible, in order to obtain rigidity. A large bearing is also generally used on the arbor in order to be able to bring the supporting arm close up to the cutter.

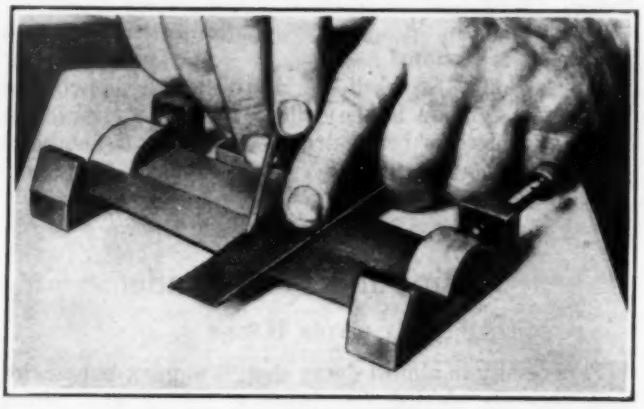
The cutter should be correctly sharpened and all play be taken up by tightening the gibs, etc., but despite all these methods used to make the machine rigid, sometimes there starts up a general chatter. Different feeds are tried out, but still the chattering continues, with wrenches and tools falling to the floor, generally accompanied by much profanity on the part of the operator, especially if they fall on his feet. How can the chattering be stopped?

First, we must take into consideration that the milling machine in general use has a certain amount of unnecessary play in the spindle bearings. This play should be taken up as soon as is possible, in order to obtain the proper working of the machine. A mechanic who thoroughly understands bearings should be selected for this job, since expert judgment is required in setting up bearings so that the machine may be run at its highest speed. Next we find that the arbor bushing has too much play when run in the supporting-arm bearing. Some machines have taper bushings that can be adjusted, but the majority I have seen have straight bushings, and in such a case the toolmaker resorts to the use of the center in an endeavor to prevent the chattering, and although the center may help to a certain extent, the fact remains that it is too far away from the cutter, which causes a great strain upon the arbor. The main reason why milling machine arbors do not remain true is because broad cutters are used without having the proper support upon the arbor. It is my belief that a short arbor having a large center should be provided with every milling machine for use with broad cutters, thus preserving the standard arbor for the lighter and more accurate work.

Simple-Clamp Hold Downs

By Arthur Kendall

When marking off some thin strips in pairs, I experienced trouble in clamping the pieces edge to edge. I finally hit on a very good method that gave me all the satisfaction I could wish for. I procured an old piece



Simple method of holding strips in pairs

of heavy tube and sawed out two sections. These I placed in two ordinary clamps as shown in the accompanying illustration. When the clamp screws are tightened against the hold downs, they force the two strips together and, at the same time, hold them down flat, since the hold downs presses on the point of contact.

Dimensioning Drawings—*Discussion*

By J. C. P. Bode

Referring to the article by Frank C. Hudson, under the title given above, on page 442, Vol. 67, of the *American Machinist:* Beside the question of using tolerances in one direction only, i.e., plus for holes and minus for

shafts, or plus or minus in either case, there is the all-important issue of expressing them.

At present there are several methods in vogue and in order to show a few of these more clearly I will mention the plus or minus idea only, showing a few examples of tolerance requests as I have encountered them. Perhaps the most common way of expressing the size is for instance 2.5 in. plus or minus 0.0005 in. We also find $\frac{2.5005}{2.4995}$ in use in some plants. There is still another method occasionally used to express the same tolerance. In the latter case the plus or minus figure applies to the last figure in the number, and the basic figure must have enough zeros, or decimal figures, to take the place of the zeros in the plus or minus figure. Thus, if we were to express 2.5 plus or minus 0.015 it would be written 2.500 plus or minus 15.

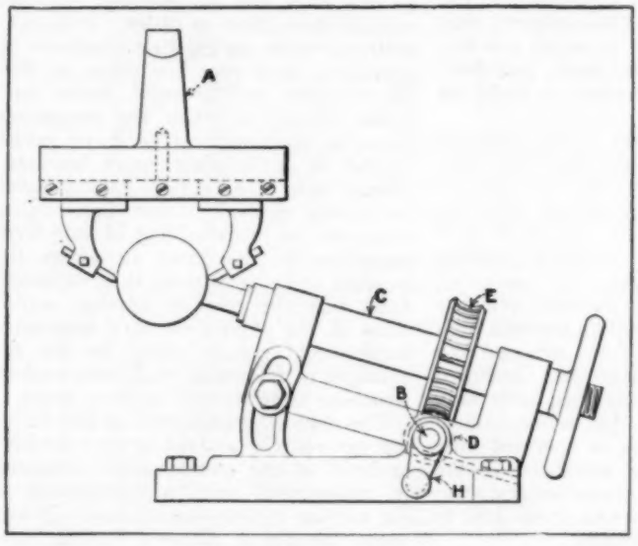
No doubt every proponent of his favored system has his pet reasons. Personally I prefer the most fool-proof way, the one that may require a trifle more space on the drawing, which however to my way of thinking is the most direct, as follows: $\frac{2.5005}{2.4995}$. If a tolerance is written in that manner no one can possibly misunderstand it and when "'miking," the figures represent direct readings, requiring no adding or subtracting, nor guessing or disputing.

Tools for Turning Balls in the Drill Press

By Jim Henderson
Toronto, Canada

A tool and a fixture for use in turning small balls in the drill press, are shown in the illustration.

The tool *A* has a slide on the end of its shank to carry two adjustable toolholders. The fixture is hinged at *B* and can be set at any angle within the limits of the curved slot at the opposite end. The spindle *C* is hollow and has a draw-in collet for holding the work.



Fixture for turning balls

The spindle is revolved by means of the worm *D* and the wormwheel *E*, by operating the crank *H*. The fixture can be used in a lathe or a milling machine by mounting it on an angle plate.

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Definition of Subpress

Q. What is the definition of the term "subpress" as it is employed in die making?

A. A subpress is a unit composed of punch and die complete with a guide, but without power, and having a spring for returning the punch. A subpress is intended to be placed in any press without fastening to the ram. A punch and die operating together on guides, but intended to be bolted or pinned to the ram of the press is called a pillar press, but not a subpress.

Comparing Shop Overhead

Q. Have you any cost data comparisons of machine shops that would show us the proper relation between non-productive and productive labor, and the relations of labor to total production costs? Also, we would like to get the proper proportion of superintendents and foremen to productive labor.

A. There does not seem to be anything very definite in cost ratios, and ratios of non-productive to productive labor in machine shops unless the shops are doing identical work. You can readily see that where duplicate work is being done by automatic machinery, the labor cost in proportion to total expense is apt to be low as compared with a machine shop having a variety of work. On the other hand, in such a shop the proportion of administrative or so-called non-productive labor is likely to be very high as compared with the general class of machine shop.

There is also a great difference of opinion as to what is to be considered productive and non-productive labor. In some shops, for example, inspection is considered as a production operation and is charged directly against the particular job, while in others inspection is carried into general overhead labor cost. The varied ideas of what constitutes overhead are undoubtedly partly responsible for the great differences in overhead percentages added to work in various shops. These percentages may run from 20 to 100 per cent, or even higher.

There are, of course, other factors that govern the shop overhead. The amount of labor in proportion to the material going into the article may vary greatly. The size of the article, which governs the shop space required, is also important. The best rule to go by is to charge everything possible directly against the job at hand, thus keeping to a minimum the items that enter into shop overhead. Also, where it is possible to do so without adding too much to the clerical work, that is, in fairly large plants, it is best to proportion the overhead amongst the various departments so that, for example, an article on which there is no foundry or forge shop work will not be burdened with the overhead of these departments. In labor overhead charges, also, it is often practical to apportion general supervision so that a product that is running along smoothly in production will not be burdened with a share of superintendence cost equal to that given other products requiring constant attention on the part of executives.

Technical Abstracts

Identification of Piping Systems

A scheme for the identification of piping systems was recently recommended by a sectional committee organized under the procedure of the American Engineering Standards Committee. The scheme has been limited to the identification of piping systems in industrial plants and power plants, not including pipes buried in the ground and electric templets.

Materials carried in pipes have been divided into five classes, and certain colors have been selected for identifying them: Safe products are those involving no hazards in their handling and no extraordinarily high value. The identifying color is green, or the achromatic colors white, black, gray or aluminum. Dangerous materials, such as fire producers and explosives, should be marked yellow or orange, while protective materials, such as antidotes for poisonous fumes, should be marked bright blue. Extra-valuable materials are identified by deep purple, while fire protection pipes are marked in red.

The identification mark can be in the form of a band of color alone with a stencil legend placed on the color band, or with additional colored stripes of contrasting hues at the edge of the color band. These identification marks should be placed at intervals throughout the piping system to insure ready identification during repairs and in emergencies. The entire pipe can also be painted the identifying color, if desired. —*Mechanical Engineering*, October.

Iron Silicon Alloys

In the region up to 1.5 per cent of silicon lie the structural steels. Here a unit of silicon brings about a considerably larger increase in strength and yield point than obtainable with any other generally used element. From 3.5 to 4.5 per cent of silicon lies in the domain of transformer steel and iron. This amount of silicon decreases enormously the hysteresis losses in magnetic induction steels. Alloys of this composition are not very ductile, but retain the ability to be cold rolled.

Above 5 per cent silicon content the plasticity drops suddenly, and the alloys become brittle. No steel or iron above 5 per cent silicon is considered suitable for either forging or rolling. Above 11 per cent of silicon the alloys begin to show a continuous increase in corrosion resistance. At 14.5 per cent silicon the corrosion resistance property remains stationary up to 17 per cent silicon, beyond which point it decreases again.

This resistance to corrosion renders the alloys with 13 to 17 per cent silicon highly important for the chemical industries. Castings made of alloys in this range, containing from 0.5 to 1.2 per cent of carbon and 0.5 to 1 per cent of sulphur, phosphorus, and manganese, form the least expensive material for apparatus that is to resist the action of various acids.

The most important drawback of the silicon alloys is their brittleness, although castings can be made with an excellent smooth surface and possessing fair strength. Such castings require practically no machining, but they must be carefully protected from shock to prevent breakage. All of the silicon alloys up to 10.5 per cent silicon, if cast under suitable conditions, will forge without much trouble, but they become brittle on cooling, and the more rapid the cooling, the more brittleness is induced. The basis of the acid-resistance alloys is the compound Fe_2Si. Beyond its composition, which is 14.4 per cent silicon, the alloys will show the presence of a secondary constituent, which does not disappear on heat treatment.—M. G. Corson, *The Iron Age*, Sept. 22.

Putting the Airplane to Work

Under the above title, C. F. Lienesch, aeronautic engineer of the Union Oil Co., presents a good outline of the potential industrial markets for airplanes. Some of the specific applications mentioned are: Mail and express matter; transferring passengers from steamships at sea to the land; forest fire patrol work, and transportation of men to the fire; distribution of newspapers, and the carrying of payrolls. He contends that aircraft landing fields in cities are less expensive than railroad yards, and their establishment can do much to build up industry in cities.

Major C. T. Moseley, of the Western Air Express, Inc., which operates from Los Angeles to Salt Lake City and is one of the very few companies showing a profit at present, is convinced that military engineering airplane practice is too costly for commercial operation, in which the highest consistent cruising speed is needed rather than extreme high speed. This company has attained low maintenance cost, and has operated 700,000 miles in 17 months, with only four forced landings due to mechanical troubles. Each plane is operated only one day out of three, remaining in the hangar two days for inspection and servicing. Engines are run from 150 to 170 hr. between overhauls.

On the Chicago to San Francisco mail route, the pilots fly at an altitude of 13,000 ft. to clear the mountain ranges, and higher if the weather is cloudy. The load on part of the route exceeds 1,200 lb., but is necessarily much lighter on the part going over the mountains.—*Journal of the S.A.E.*, October, 1927.

Should You Lease, Buy or Build a Plant?

When increased plant facilities are necessary four opportunities are open to manufacturers: To lease space in loft buildings, or an entire plant, to lease a plant built to order for the manufacturer's specific use, to buy an existing building, or to build one's own plant.

Leasing sometimes results in greater net profit than owning a building. It frees the manufacturer from the necessity of making a substantial capital investment, and allows this money to be devoted to other uses, particularly if the firm is in process of development. In this case a smaller amount of cash capital is necessary. Leasing also frees the manufacturer from ownership risks and obligations. In the event of fire or other damage the lessee is not required to pay further rent, whereas the fixed charges on an owned plant will continue while a new one is being built, although not in the full amount.

The advantages of leasing have been vastly broadened in recent years by the establishment of companies that will develop industrial buildings to order under a long-term lease contract. Rentals under this system are based upon the actual fixed charges incurred plus a profit to the investment company. The total charges average about 10 per cent.

Ownership of a plant is desirable when the requirements are so highly specialized that no existing buildings of the proper type are available for lease, or are such that no investor will develop a new plant to order. It is also desirable when an existing plant can be purchased at a very low price, so that the charges are brought below any rental figure, or when the company's financial position enables it to invest capital in a building more advantageously than using outside capital under the leasing method. Other factors that enter are the inadvisability of long-term leases on the one hand, or where the location and type of plant is so definitely fixed that the cost of moving equipment at the expiration of a long-term lease would not be offset by the advantages of relocating in a more modern structure after twenty to forty years.

The choice between buying and building can only be arrived at by a detailed analysis of the various costs entering, in conjunction with a comparison of the various factors in each case. In any event the choice between leasing, buying or building should only be made after the complete facts have been ascertained. The benefits accruing from choosing the right course are almost inevitably worth many times the effort needed to find it.—Tyler Stewart Rogers, *Manufacturing Industries*, September.

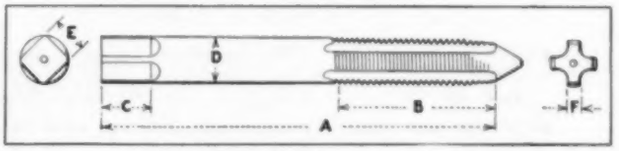
Standard Tap Dimensions

(Continued from sheet 12a)

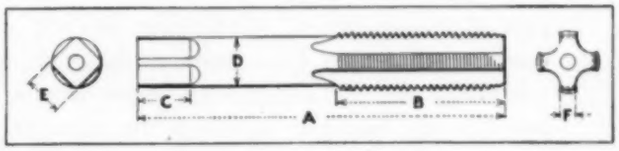
Frequently, threaded holes in aluminum will require 2-flute taps. Large threaded holes in parts where there is a thin wall construction may also require a 6- or 8-flute tap.

It is required that ground-thread taps be ground on the chamfer concentric with the threads with a very slight radial relief or back-off to prevent the tap cutting oversize. Difficulty will be experienced with taps cutting oversize in the softer materials, such as aluminum, if this requirement is not adhered to.

Straight pipe taps are intended for use in place of taper pipe taps where oil-tight joints under low pressure are required, such as holes for Alemite and Zerk fittings and drain plugs. Holes produced by these taps should be measured with a standard American (National, Briggs) taper plug gage. They should not be measured with a straight plug gage. It will be noted that the shank and square dimensions coincide with those of the hand plug taps and, therefore, these taps may be used in the same tap drivers.



Standard Machine Screw Tap



Standard Straight Pipe Tap

Heavy tapping pastes or compounds are not recommended. Where it is noticed that taps purchased to these specifications produce holes larger than their respective gage limits, investigation should be made of machine conditions, speed of taps, alignment of fixtures and lubricants.

Dimensions for Straight Pipe Taps with Ground and Cut Threads

Size	Pitch Diameter				Major Diameter			General Dimensions					
		Minimum			Minimum			Overall Length	Thread Length	Square Length	Shank Dia.	Square Size	Land Width
	Basic	Ground	Cut	Max.	Ground	Cut	Max.	A	B	C	D	E	F
¼–27	.3748	.3690	.3680	.3700	.3980	.3975	.3995	3 3/16	1 3/16	11/64	.323	.242	.102
⅜–18	.4899	.4820	.4810	.4830	.5260	.5255	.5275	3 11/16	1 11/16	1/2	.429	.322	.136
½–18	.6270	.6190	.6180	.6200	.6625	.6625	.6645	3 11/16	1 11/16	3/8	.480	.360	.172
¾–14	.7784	.7680	.7670	.7695	.8250	.8245	.8270	4 11/16	2 1/16	9/16	.697	.523	.200
1–14	.9889	.9785	.9775	.9800	1.0345	1.0345	1.0370	5 1/16	2 1/16	3/4	.896	.672	.250
1–11½	1.2386	1.2260	1.2245	1.2275	1.2945	1.2945	1.2970	5 3/4	2 1/16	1	1.021	.766	.292

Dimensions for Machine Screw Taps with Ground and Cut Threads

Size	Pitch Diameter				Major Diameter					General Dimensions					
			Maximum		Ground Thread			Cut Thread		Overall Length	Thread Length	Square Length	Shank Dia.	Square Size	Land Width
	Basic	Min.	Ground	Cut	Basic	Min.	Max.	Max.	Max.	A	B	C	D	E	F
0–80	.0519	.0524		.0534	.0600			.0610	.0625	1 3/16	1/4	1/4	.141	.110	
1–64	.0629	.0634		.0644	.0730			.0740	.0755	1 3/16	5/16	1/4	.141	.110	
1–72	.0640	.0645		.0655	.0730			.0740	.0755	1 3/16	5/16	1/4	.141	.110	
2–56	.0744	.0749		.0759	.0860			.0875	.0890	1 3/16	5/16	1/4	.151	.110	
2–64	.0759	.0764		.0774	.0860			.0875	.0890	1 3/16	5/16	1/4	.141	.110	
3–48	.0855	.0860		.0870	.0990			.1005	.1020	1 3/16	5/16	1/4	.141	.110	
3–56	.0874	.0879		.0889	.0990			.1005	.1020	1 3/16	5/16	1/4	.141	.110	
4–40	.0958	.0963		.0978	.1120			.1135	.1155	1 3/16	5/16	1/4	.141	.110	
4–48	.0985	.0990		.1005	.1120			.1135	.1155	1 3/16	5/16	1/4	.141	.110	
5–40	.1088	.1093		.1108	.1250			.1265	.1285	1 3/16	5/16	1/4	.141	.110	
5–44	.1102	.1107		.1122	.1250			.1265	.1285	1 3/16	5/16	1/4	.141	.110	
6–32	.1177	.1182	.1187	.1197	.1380	.1395	.1410	.1395	.1415	2	3/8	1/4	.141	.110	
6–40	.1218	.1223		.1238	.1380			.1395	.1415	2	3/8	1/4	.141	.110	
8–32	.1437	.1442	.1447	.1457	.1640	.1655	1.670	.1660	.1680	2 1/16	7/16	5/16	.168	.131	.042
8–36	.1460	.1465		.1480	.1640			.1660	.1680	2 1/16	7/16	5/16	.168	.131	.042
10–24	.1629	.1634	.1639	.1649	.1900	.1925	.1940	.1925	.1945	2 3/16	7/16	5/16	.194	.152	.050
10–32	.1697	.1702	.1707	.1717	.1900	.1915	.1930	.1925	.1945	2 3/16	7/16	5/16	.194	.152	.050
12–24	.1889	.1894	.1899	.1909	.2160	.2185	.2200	.2185	.2205	2 3/16	1/2	5/16	.220	.165	.056
12–28	.1928	.1933	.1938	.1948	.2160	.2180	.2195	.2185	.2205	2 3/16	1/2	5/16	.220	.165	.056

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Profitless Prosperity

"SELECTIVE Prosperity" has apparently served its purpose as a catchword to describe current business conditions and is being retired in favor of "Profitless Prosperity." The more familiar expression is really the more accurate of the two but so many businesses are just discovering that they have been working vigorously without profit that the general impression is growing that the situation in which the average enterprise finds itself is truly profitless, and the common experience.

There are outstanding exceptions, of course. General Motors, for instance, expects to make well over two hundred millions in 1927. But the exceptions are well managed, well equipped and usually very strong financially.

As the profit margin narrows it behooves the business manager to do his utmost to reduce every cost item that can profitably be reduced. This statement is qualified because there may be expense items that should be increased if the total cost is to be lessened. Before the manager can make intelligent reductions he must know what his costs actually are, which means that he must have a sensible cost accounting system. It is desirable that competing firms use the same system in order that ruinously low prices be not set by some company that does not know what its costs are and therefore underestimates them.

With a true knowledge of his costs, and sound business methods on which to base his activities, there is no reason why the average manager should continue profitless business.

The International Fixed Calendar

AGITATION for a thirteen-month year continues, particularly among business men, who especially recognize its advantages. A recent address by George Eastman before the U. S. Chamber of Commerce pointed out the many defects of the present calendar and sixteen advantages of the International Fixed Calendar, as the proposed simplification is to be called.

It is proposed to start the new calendar in 1933, as that time New Year's Day will be on Sunday, and it is necessary to start the new calendar in this way. The next available date after that is 1939.

Many concerns are already using a year made of thirteen months of twenty-eight days each in their own accounting systems. One of these is a large distributing company with fifteen thousand chain stores. It is also being used by individual companies in Great Britain, Germany, Czechoslovakia and other countries.

The objection that calendars cannot be changed is, of course, futile. Nations with populations totaling over 300,000,000 have changed their calendars since the war. The Turkish government has changed its weekly rest day from Friday to Sunday, and in a few years the change will have been almost forgotten. And let us not forget that the present calendar is an arbitrary human device badly bungled by Roman emperors.

In order to have the change effective in 1933, world sanction must be secured by December 31, 1929. This is the last day when changes may be made for 1933 by both the Greenwich and the U. S. Naval Observatory.

In the words of a well-known manufacturer, "Eventually, why not now?"

Decimals Are Not Metric

A LOT of people mix up decimals with the metric system. They talk about the advantages of using "tens" and "tenths" as though that could be done only with the metric system, when, as every shop man knows, thousandths are the daily diet of practically all mechanics in modern shops. The convenience of decimals in connection with fine measurements is recognized. Tenths of a thousandth are not uncommon in many classes of work.

The objection to the metric system does not come from its use of decimals, but from the change in the unit of measurement. Not only is the inch more convenient but it is the unit used in building perhaps 85 per cent of the machines in use in the world today. Changing from one unit to another would involve untold confusion and expense.

It is not particularly easy to translate dimensions involving tenths of thousandths of an inch into millimeters, even on paper. But it is far more difficult to do the translating in iron and steel and have the parts fit as they should. Those who tell us that it is easy are among the sort of optimists who make confirmed pessimists of those who have to deal with them.

Shop Equipment News

Greenlee 1¼x6-Inch Four-Spindle Automatic Screw Machine

RECENT developments in the line of machine tools made by Greenlee Bros. & Co., Rockford, Ill., include a four-spindle 1¼x6-in. automatic screw machine, in which are incorporated some unusual mechanical movements hitherto not used in screw machine design. Front and rear views of the machine are shown in the accompanying illustrations.

The tool slide, a section of which is an inverted T, is operated through its cycle by a rack (attached to the slide and driven through intermittent gearing between the ways) in combination with a plate cam for positioning the slide at the ends of its stroke and keeping it in proper relation to the intermittent gearing. The quick-return, approach and feeding cycle of the slide is controlled by adjustable dogs operating high- and low-speed clutches.

Each spindle is mounted on four Timken roller bearings, with the drive gear carried in the middle. The spindle carrier is a one-piece casting, with provision for eliminating end motion and for accurate cut-off duplication. Indexing of the spindle carrier is effected by a combined Whitworth crank motion and a Geneva movement driven from the main gear box. The locking pin, which is securely gibbed to the spindle carrier housing, is a wide, flat wedge located in the center of the spindle carrier in an adjustable, hardened and ground seat. The seat is straight on one side and tapered on the other.

Indexing and stock feeding takes place between the fourth and first positions, leaving the fourth position open for end operations as well as cutting-off.

The chuck-closing spools mounted at the rear of the spindles are made in three pieces, consisting of a bronze body, free to rotate on the spindle, a rotating spool mounted on the body, and a hardened sleeve. The entire unit is automatically lubricated through the spindle. The spool, instead of rotating in the operating shoe, rotates on its bronze body, and has a rolling action in the shoe when indexing. The stock pusher ring is also free to rotate on the feed tube. The shoes are carried on parallel motion arms with rollers engaging drum cams for movement. The stock pusher shoe is arranged with a compensating spring to prevent breakage of stock pushers when the stock is exhausted.

Four cross-slides are provided, one for each spindle, mounted on bearing brackets attached to the frame and spindle carrier. Movement is through a rack and segment arm controlled by small pick-off cams engaging two rollers, thus providing positive travel in two directions. Independent feeds are available for all four slides, with the cams interchangeable for each position. The maximum travel of the slide is 1¼ in. All gearing and shafts in the speed and feed box, as located at the end of the machine, are of alloy steel, heat-treated and mounted on either ball or roller bearings. Pick-off gears are provided for spindle speed and feed changes, and they are accessible through doors in the box. Spindle speeds range from 250 to 1,200 r.p.m., while the feeds range from 0.002 to 0.015 in. per revolution of the spindle. An adjustable safety clutch is mounted on the main worm drive shaft, and it functions in case

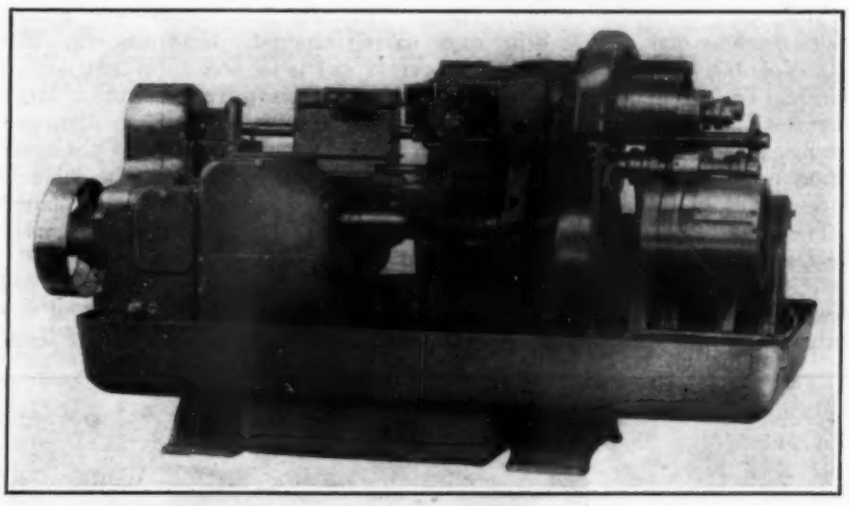


Fig. 2—Rear view of the Greenlee Automatic Screw Machine

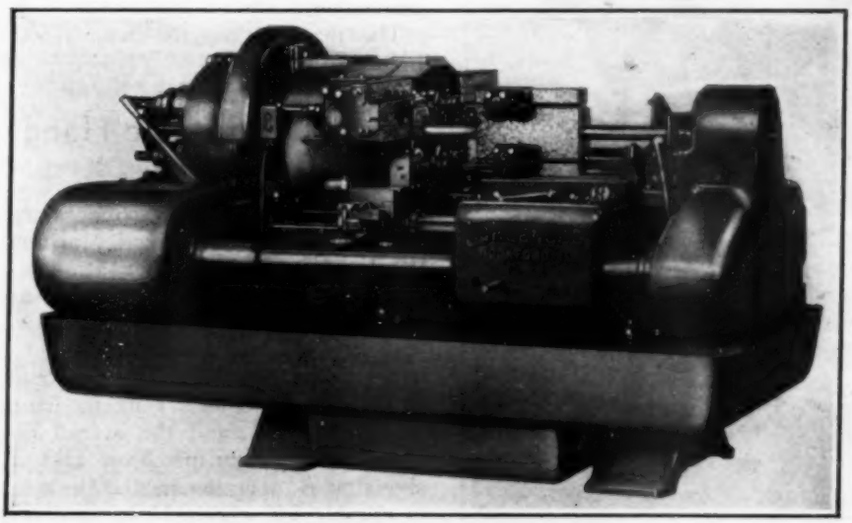


Fig. 1—Greenlee 1¼x6-Inch Four-Spindle Automatic Screw Machine

Automotive Production

an overload is placed on the tool slide.

A geared oil pump, quickly detachable for inspection, is located in the bottom of the speed box for distributing oil from a reservoir to practically all moving parts of the machine, including the speed box gearing and bearings, spindle gearing and spindle bearings, tool slide, cross-slide, and their operating parts. A glass tube is provided on top of the head to indicate whether the oil is flowing properly. A self-contained coolant system is also applied to the machine, and is built integral so that all piping to tools carried on the cross slide is eliminated.

When individual motor drive is required, the motor is mounted on the front of the bed below the spindle carrier. Power is transmitted to the speed box by a housed longitudinal shaft at the front of the bed. For single-pulley belted drive, a plate is removed at the end of the speed box and a bracket carrying the pulley, shaft, bearing and the necessary gearing is attached.

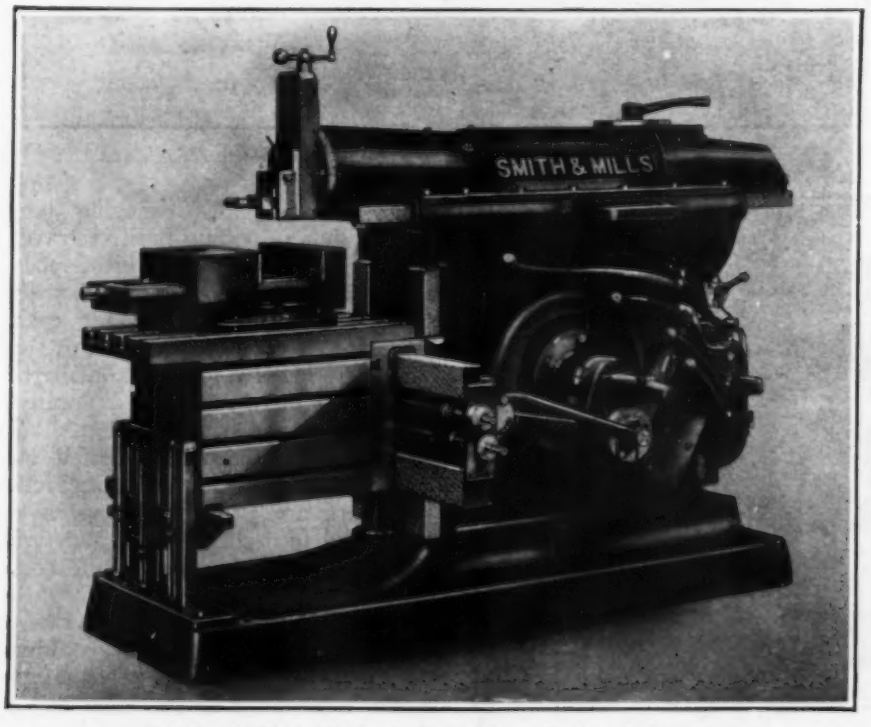
Smith & Mills 32-Inch Back-Geared Crank Shaper

WITH the 32-in. back-geared crank shaper shown in the illustration an additional size is available in the line put out by the Smith & Mills Co., Cincinnati, Ohio. The 25-in. machine was described in page 410, Vol. 67, of the *American Machinist*. The 32-in. size is regularly furnished with single-pulley drive, having a twin-dish clutch and self-acting brake. In principle of design it resembles the smaller unit.

The column is heavily ribbed, and the ram ways are also reinforced and have ample bearing surfaces. The base is heavy and is also ribbed to form an ample foundation for the machine. A pad is provided at the outer end for the table support which is somewhat different in design from that used on the smaller machine.

The ram has square-type guides having tapered gib adjustment. The cross rail is of box form and is well ribbed. It is provided with a large bearing surface and is so arranged that the apron and table do not overhang on the feed side. The table is also of box form with slots planed from the solid, and it extends over and bears on top of apron.

The rocker arm is of semi-steel and is mounted on a pivot shaft at the bottom. The sliding block is of semi-steel, bronze-bushed, and the bull wheel is also semi-steel with helical cut teeth. It is protected by a guard cast solid with the column on the inside.



Smith & Mills 32-Inch Back-Geared Crank Shaper

Bolted to the back of the column is a speed box providing, by means of two levers, four changes of speed, which combined with the back-geared drive gives eight different cutting speeds to the ram. All gears are of the cluster type made of alloy steel, heat-treated and with rounded teeth to facilitate easy meshing. All sliding gears are broached and are mounted on multiple-splined shafts carried on tapered roller bearings. The single drive pulley is also carried on roller bearings.

On the table is a single-screw, parallel-jaw vise with graduated swivel base. The table support is of improved design. The housing for the adjustable support block is securely bolted to the base and a gib is provided for maintaining proper contact with the table.

This shaper is regularly furnished with a one-shot, hand-operated lubricator which provides fresh oil to all main revolving shaft bearings and ram ways. The system comprises a supply tank, pump and distributing units or headers connected by suitable tubing to the particular bearing of the machine.

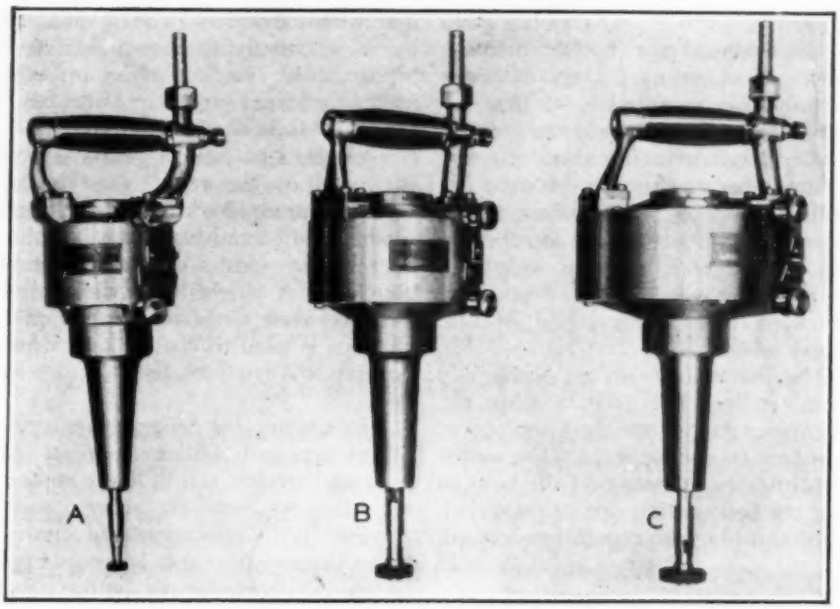
Motor drive can be furnished as optional equipment. This arrangement consists of a pad securely bolted to the base of the machine. The drive is by means of a fibre pinion on the motor shaft to a large gear on the driving shaft of the shaper. A constant-speed type of motor is recommended.

The machine weighs about 6,500 lb. net.

Onsrud Pneumatic Hand Grinders

Small pneumatic hand grinders are being made by the Onsrud Machine Works, Inc., 3900 Palmer St., Chicago, Ill. Three sizes are made as shown in the accompanying illustration. At *A* is shown type E-3-C, which operates at 28,000 r.p.m. and is suitable for wheels 1 in. in diam. It weighs 8 lb., and the overall dimensions are 16x6 in. Type H-3-C, shown at *B*, operates at 20,000 r.p.m. is suitable for wheels 1½ in. in diam. Its weight is 9 lb. Type K-3-C,

Shop Equipment News



Onsrud Pneumatic Hand Grinders

shown at *C*, operates at 14,000 r.p.m. and is suitable for wheels 2 in. in diam. The weight of the last two tools is 9 and 10 lb., respectively.

Each tool is suitable for connection with ¼-in. hose and for operation with air pressures from 90 to 100 lb. per sq.in. The air consumption is 20, 25 and 28 cu.ft. per min. for the types E-, H-, and K-3-C. respectively.

The driving mechanism is a three-stage turbine with three rotating and two fixed sets of vanes. The turbine rotor is carried upon ball bearings provided with adequate lubrication and cooled by the exhaust air. Ample power is provided so that the wheels will maintain their speed under load. The smallest unit develops ⅜ hp. by actual Proney brake tests. The units are light in weight, but they may be suspended from the ceiling with an extension spring to eliminate the weight for die work. The air consumption is regulated by turning the handle grip. One-quarter of a turn opens or shuts the valve completely. Interchangeable extension spindles are available for various types of work.

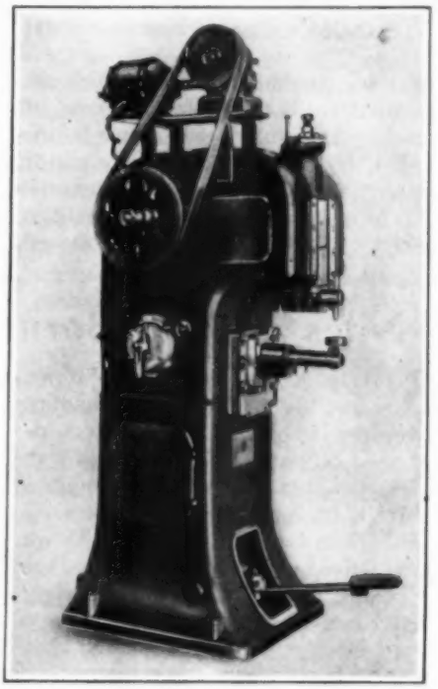
Gibb Welding Press

AN ENTIRELY new principle in spot welding is employed in the welding press made by the Gibb Welding Machines Co., Bay City, Mich. The welding press is a combination of an automatic spot welder and punch press. It differs radically from an automatic spot welder, however, in both construction and in results of operation. Whereas spots are normally made in one second, the welding press makes spots in one hundredth part of a second. This increase in speed is accomplished by means of a specially-designed transformer and a precisely-timed automatic switch.

In its action the transformer has the characteristics of a condenser in that it discharges its current instantaneously. The object of increasing the speed of welding, aside from the increased production obtained, is to make welds without depressions in the surface, warpage or discoloration. The weld is made before the heat has an opportunity to soften the outer surfaces of the sheet. Welds can be made at the rate of 200 or more spots per minute.

The press has a smooth toggle action that quickly brings the welding points lightly into contact with the work and gives a final forging pressure, which is limited only by the strength of the machine. Due to the double action of the toggle the hammering of the copper points is avoided. This smoothness of action insures long life to the moving parts, but more particularly, together with the instantaneous heating, preserves the welding points, thus eliminating constant redressing and consequent loss of production.

Many applications are cited where this type of welding machine is particularly suited: To more precise welding of light to heavier parts; to welding spouts to bodies of oil cans, coffee pots, tea kettles, and the like; and in attaching ears, clips or lugs



Gibb Welding Press

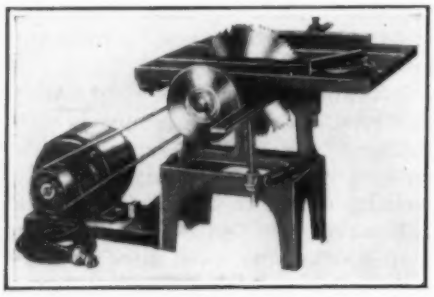
to containers. In the last example, a special double-acting welding press is employed, whereby two spots are made at one stroke. The unit is also suited for finely polished surfaces where the finish should be maintained, such as on automobile bodies. In addition the press can be used for welding rivets, pins or any shaped rods on end to flat surfaces; for welding hardware parts such as locks, catches and the like; and for welding non-ferrous metals such as brass and aluminum.

S. & B. No. 8 Combination Saw Outfit

A small Universal sawing outfit has been made by the Scott-Bansbach Machinery Co., 132 S. Clinton St., Chicago, Ill. It can be used for both wood and metal work, and can be supplied with a number of extra attachments to increase its utility.

The unit is regularly supplied with

Shop Equipment News



S. & B. No. 8 Combination Saw Outfit

an 8-in. combination saw, which can be used for both ripping or cross cut work. A 12-in. ripping fence is provided, as well as an adjustable cut-off miter gage. The saw table measures 12x16 in. and is equipped with a 2-in. insert. When this insert is removed, the machine can be used with a dado or planer head for special molding work. For certain classes of work the table can be tilted to 45 degrees.

The table can be tilted back and a guard placed over the saw. In this position the machine can be used for drilling, grinding or polishing when the necessary devices are attached to the spindle ends. These include a 6-in. buffing wheel, a $\frac{3}{8}$-in. 3-jaw drill chuck, a 6-in. sander, and a 5-in. emery wheel.

The machine is driven through a $1\frac{1}{4}$-in. endless belt from a $\frac{1}{4}$-hp. a.c. motor regularly furnished for operation on a 60-cycle circuit. The motor is adjustably mounted on the base so that the belt tension can be regulated. Cord and plug are regularly supplied.

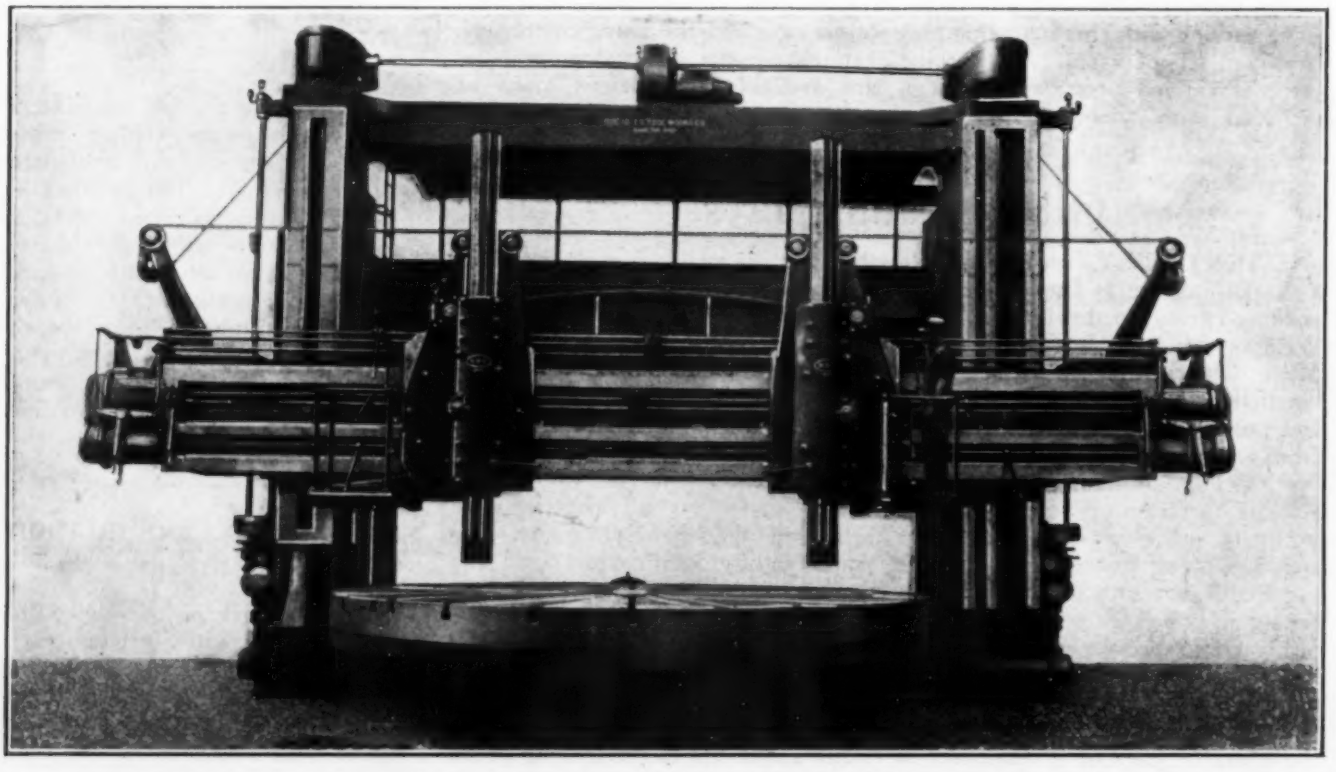
Niles 20-Foot Boring and Turning Mill

SLIGHTLY increased capacity and a number of additional features over the 18-ft. mill, which was described on page 674, Vol. 66, of the *American Machinist*, are noted in this 20-ft. heavy boring and turning mill made by the Niles Tool Works Co., Division of Niles-Bement-Pond Co., Hamilton, Ohio. The right-hand housing has been built of considerably heavier proportions than the left-hand housing and the housing space widened and provided with a three-track bearing to receive a side head.

Both the saddle feed and the bar feed for either head may be engaged simultaneously for the purpose of cutting tapers and in conjunction with the swiveling of the saddles, tapers may be cut that could not be obtained by the sole use of the down feed combined with the swiveling of the saddles. The engagement of the combined feeds is secured through positive clutches housed in gear cases at each end of the rail. The regular feeding and rapid traverse movements of the saddles and bars, however, are operated by means of large friction clutches. A single lever with interlock between positive and friction clutches is used to change over from positive to friction feeds and vice versa.

The motors for the rapid traverse of the bars and saddles are located at each end of the rail. These motors are inactive except when rapid traverse is in operation, the control being through traverse levers, which, in action, depress push buttons that govern the motors.

The rail is clamped to the housings by four electric clamping devices, two for each housing, the rail being held both inside and outside the housing. These motors are of the high-torque type, rated at $\frac{1}{2}$ hp., operating through a worm and gear segment. Clamping nuts are connected to these parts by cranks and levers. There are four clamping bolts for each housing.



Niles 20-Foot Heavy Boring and Turning Mill

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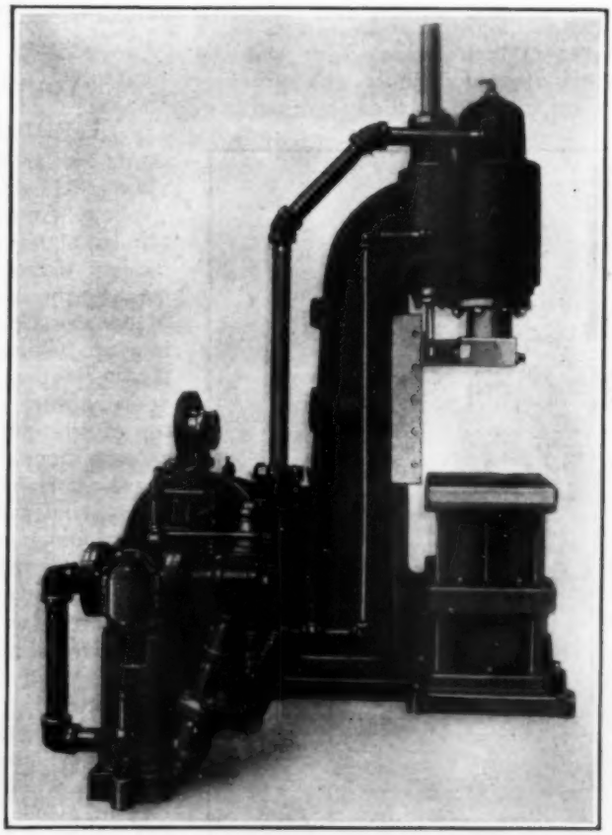
The main drive is through a 50-hp. variable-speed d.c. motor, while a 20-hp. motor is used to elevate the cross-rail. Other features such as double table tracks with pressure lubrication, steel bars, sliding-gear feed boxes, crossrail of square box section with stiffening beam, elimination of the top works by the use of separate motors for rapid traverse, direct-reading micrometer dials for saddle and bar movements, limit switch for the elevation of the cross-rail, and a built-up girder in addition to the top brace to strengthen the upper structure, are embodied in this mill, as on the 18-ft. machine previously described.

H P M "Hi-Speed" Hydraulic Stamping Press

FORTY-TWO normal working strokes per minute can be obtained on the H P M "Hi-Speed" hydraulic stamping press made by the Hydraulic Press Manufacturing Co., 20 East Broad, Columbus, Ohio. This speed gives a satisfactory production for stamping operations and permits this press to be used on work where low cost of production is an important factor. The press is flexible enough so that it can be used on deep drawing and on other work requiring any stroke from a fraction of an inch up to 18 in. It also operates over a wide range of pressures. In addition the machine features a safety device that prevents die breakage. The frame of the machine, which is shown in the illustration, is a massive one-piece casting, designed for low deflection and a high safety factor at full load. The working parts are simple. They consist of the main ram, which is merely a cylindrical casting, and the auxiliary differential pull-back ram. Both pieces have straight-line motion only. The tool holder and slide are carried by the main ram and are attached to its lower end. Accurate alignment of the moving parts is maintained by both the main ram guide in the throat of the cylinder and the slide, which is guided on the frame with adjustable gibs. These guides merely serve to keep the tool holder in line so that the punch and die will register properly. Due to the straight-line action of the pressure-producing member, there is no side thrust to be taken up. The tool-holder construction follows standard practice, having a central hole and clamp for properly mounting the punch holder.

The heavy bolster plate is mounted on a removable sub-table. This table has a central U-opening, accessible from the front. The press bed beneath the table is cast with a rectangular, cored opening through to the base. Thus, there is ample space for suspending from beneath the bolster hydraulic cylinders or other devices for operating ejectors, blank holders, and the like. In order to make the press a general-purpose one, it is also equipped with a horn for horning and wiring operations. Clearance is provided for handling work of large diameter on the horn by removing the sub-table.



H P M "Hi-Speed" Hydraulic Stamping Press

The power unit consists primarily of an electric motor with a double-end shaft, direct-connected through flexible couplings to two rotary hydraulic pumps. The entire unit is mounted on a reservoir base holding the supply of fluid required. This power unit is fitted with all devices necessary for the complete automatic control of the press. Hydraulic power is transmitted to the ram through two pipe lines without valves being interposed. Since these pipes, and a small tension rod connecting with a starting trip on the press, are the only connections between the press and the power unit, the two units may be located at various positions in relation to one another. The press and power unit form a self-contained machine and require no accumulators or other hydraulic equipment.

In production work the H M P press is under automatic control. When the treadle is depressed the following cycle takes place automatically: The press closes at fast speed; automatically shifts to the slower full-load speed, as the resistance of the work builds up; reverses the direction of the press travel, as soon as the limiting pressure is reached, and returns to its initial position and stops. This position is adjustable to any point between the extreme limits of the press travel. The pressure limit is subject to adjustment to any value from the full rating of the press to one-fifth that amount. In the unit pictured, the No. 8-OS, the maximum capacity is 75 tons.

Manual control may also be applied to the press. In this case the further the treadle is depressed, the faster the downward motion of the ram. Upon release of the treadle the press ram moves upward and stops. In this way a delicate control is obtained.

The press closes at a maximum linear speed of 440 in. per minute and

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returns at the same rate. This means that forty-two complete strokes per minute of 2½ to 3 in. each, or longer or shorter strokes with proportionately slower or faster frequency, are obtained. The speed under pressure is 70 in. per minute.

The bolster plate measures 30x22 in. and is 2½ in. thick. It is 33½ in. from the base. The height of the subtable without bolster is 15½ in. The central U-opening through the subtable measures 8x16 in. The maximum opening between the face of the slide and the surface of the bolster plate is 23 in. and the minimum opening 5 in. The overall height of the entire unit is about 117 inch.

Besly No. 161 Dry Disk Grinder

IN THE illustration is shown a front view of the No. 161 dry disk grinder made by Charles H. Besly & Co., 118 N. Clinton St., Chicago, Ill. The machine features direct-connected motor drive with power-operated oscillating tables having both geared-lever and oil feed. In the illustration spring bolts are shown in place in the operating position, also the Besly patented geared-lever feed tables equipped with oil feed cylinders for operating the table top to and from the grinding wheel.

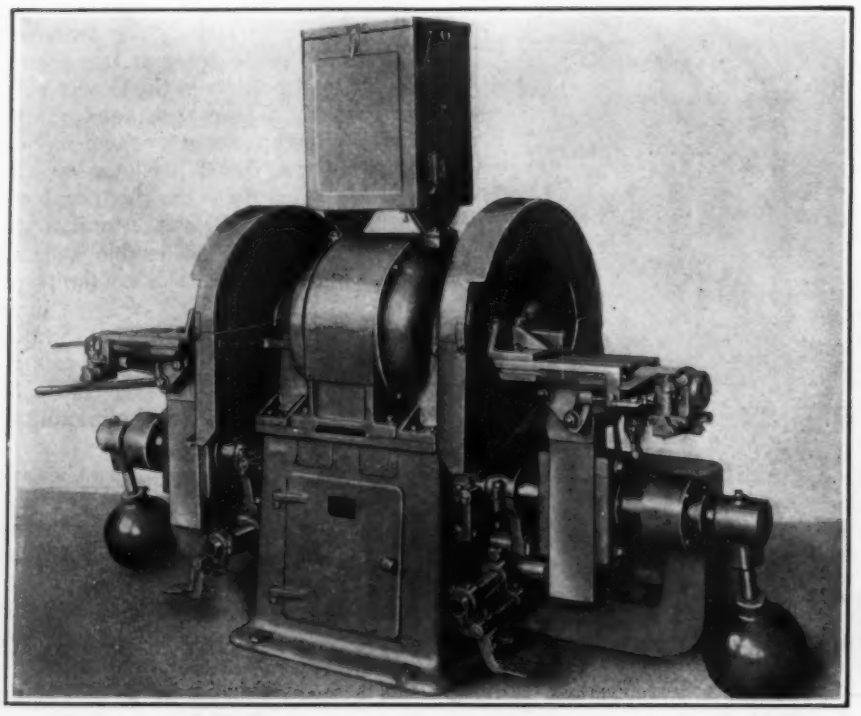
The oil cylinder is attached to the back of the table guide and operates directly on the top, while the three-way valve is built into the cylinder. The oil is supplied through piping and flexible metal hose direct from a rotary pressure pump mounted on the gear case driven by spur gears in the case. The exhaust oil is returned to the tank, which is cast integral with the transmission case, through a flexible hose and piping.

The table is attached to a heavy vertical bar which is adjustable up or down in a dovetail guide in the rocker box. Two locking devices are provided on each rocker box to hold the vertical bar securely in the position it is set. The rocker shafts are equipped with Timken roller bearings mounted in dust-proof housings on rigid outboard supports attached to the machine base.

To operate the machine the attendant places the work in position on the table, pushes the table forward, at the same time tripping a latch with his foot, thus engaging a lock bolt with a connecting rod. The oil valve lever is then pushed over and the work forced against the grinding wheel. The machine continues to grind the work until a micrometer stop-screw located on the front side of the table contacts with the table top or slide, when the feeding ceases. This stop can be set to any predetermined amount. The operator then reverses the operating valve lever and the work recedes from the grinding wheel, after which he steps on the foot pedal thus disengaging the spring bolt so that the table can be drawn forward for removal of the work and reloading.

The grinding disk is driven by a 30-hp. motor, operating at 865 r.p.m., 3-phase, 60-cycle circuit, either 220 or 440 volt. The motor is of the induction type, fully inclosed, being ventilated through the base of the machine. An automatic starting compensator is mounted on top of the motor and is controlled through a push-button switch. The grinding wheel is mounted directly on the motor spindle, which is carried in Timken tapered roller bearings.

The power oscillating and oil gear unit is driven by a ½-hp. motor at 1,800 r.p.m. through belt and belt tightener. In this case also the starter is mounted directly over the motor and is controlled by a push-button switch.



Besly No. 161 Dry Disk Grinder

"Ammco" Radial Cylinder Grinder Stand

The "Ammco" radial cylinder grinder stand was recently added to the line of motor reconditioning tools made by the Automotive Maintenance Machinery Co., 549 West Washington St., Chicago, Ill. This device, shown in the illustration, is a universal fixture that is attached to the top of the cylinder block to provide an easy method of raising and lowering the portable electric drill and cylinder grinder during the cylinder reconditioning process. It assures a uniform stroking action with less effort than is ordinarily required.

A particular feature of the stand is the universal mounting bracket with a swinging radial arm that enables the mechanic to grind all cylinder bores with only one setting of the tool, including cylinders that are close under the cowl, where they are usually difficult to grind. Removal of the cylinder bolt studs is not necessary.

Another feature is the hollow cen-

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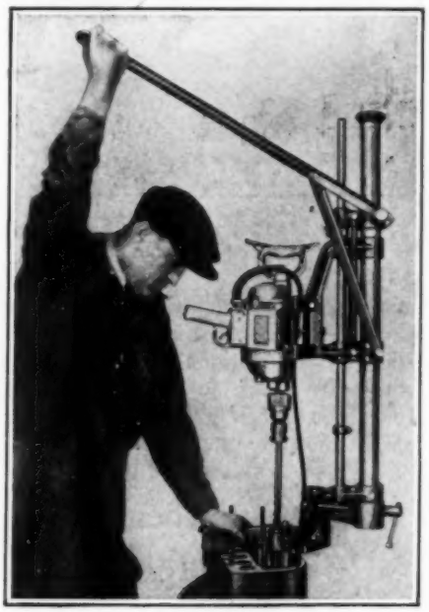
tral column which holds three quarts of kerosene. The kerosene is brought to the cylinder bore from the bottom of the column through a flexible tube, and the drip is controlled by a small shut-off cock.

The entire fixture is arranged for quick and easy set-up. The mounting block weighs only 10 lb., and is fastened to the cylinder block easily



"Ammco" Radial Cylinder Grinder Stand

and quickly. Then the rest of the fixture is lifted up and set into place. The drill mounting bracket is universal, and will take any $\frac{5}{8}$- or $\frac{7}{8}$-in. portable electric drill. Special brackets may be obtained for installing the stand on benches or any part of the chassis to hold an electric drill for other drilling operations.

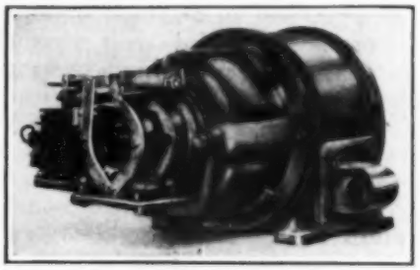
Two stops are provided on the central column to limit the up and down travel of the grinder in the cylinder bore, thus preventing the grinder from being withdrawn too far while revolving, and likewise preventing it from striking the crankshaft or the bearing lugs when moved downward.

General Electric Totally-Inclosed Motors for Portable Hoists

A line of motors was recently developed by the General Electric Co., Schenectady, N. Y., for use with portable electric hoists. The motors are also suitable for other applications involving intermittent operation and high starting torque. The line includes motors from 1 to 10 hp. in the d.c. types; from 1 to 11 hp., single speed, 2 and 3 phase; and from 1 to 5 hp., single phase, in the a.c. types. Two- and three-phase slip-ring type hoist motors are also included in ratings from 3 hp. up.

The new motors are totally inclosed and all parts are well protected. The bearings are of the waste-packed, sleeve type, and are protected against the entrance of dirt from the outside. The d.c. motors are series wound, while the a.c. motors of the polyphase type have high-resistance rotors. The single-phase motors are said to have an unusually high starting torque.

In most of the applications for which the motor is designed, a brake



General Electric Totally-Inclosed Hoist Motor with Solenoid Brake

is required. Accordingly the motors are all built with the shaft extended from the drive side to take a brake and the motor end-shield is fitted with pads or bosses with drilled and tapped holes for mounting the brake. In the illustration a 5-hp. series wound d.c. motor is shown with a solenoid brake.

Betts Large-Size Double Horizontal Boring and Drilling Machine

WHILE the large-size horizontal boring and drilling machine shown in the illustration was especially designed for the economical performance of boring operations on cast-steel locomotive frames having the cylinders cast integral with the frame, it is adaptable to a wide range of boring and drilling operations on large work. The unit was recently built by the Betts Works of the Consolidated Machine Tool Corporation of America, Rochester, New York.

In Fig. 1, a general view of the machine is shown. It has a long bed on which two columns are mounted, each column carrying a saddle with the necessary mechanism for driving, feeding and rapid traversing the spindles. Both spindles are 9 in. in

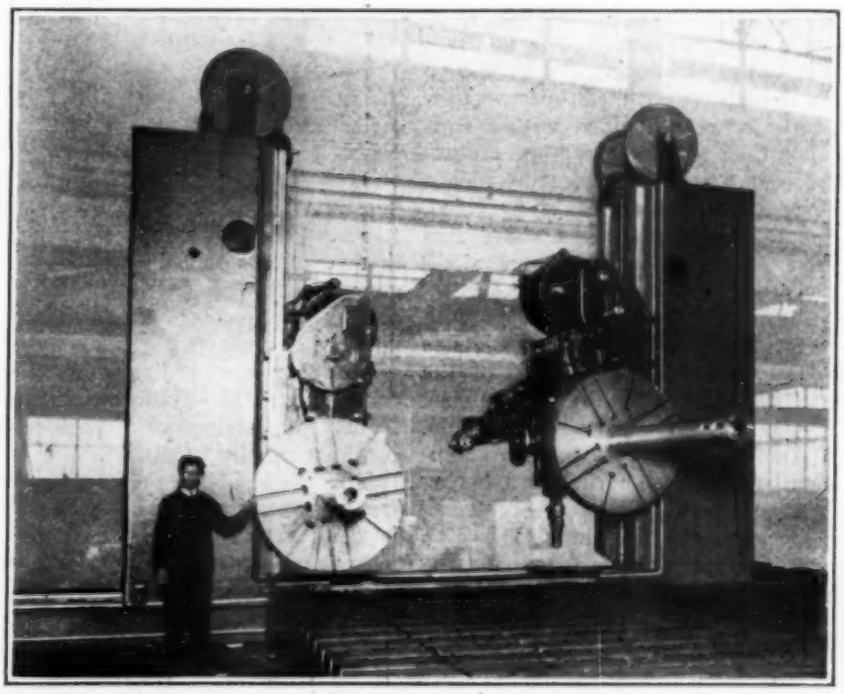


Fig. 1—Betts Large-Size Double Horizontal Boring and Drilling Machine

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diameter, and in addition to direct drive, are provided with internal faceplate drive for heavy boring. Each saddle carries its own driving motor, a 4-to-1 variable-speed type rated at 35 hp., which in combination with two mechanical speed changes gives a wide range of spindle speeds with a small number of gears.

A close-up view of one of the saddles is shown in Fig. 2. Each saddle is equipped with an operator's platform, from which all movements of the unit itself and the spindle are controlled. Push buttons are used to operate the motors. As can be seen in this illustration, this spindle, which is the left-hand one shown in Fig. 1, can be tilted from the horizontal up to 15 deg. The right-hand spindle cannot be so tilted. Both spindles have a simplified feed mechanism suitable for boring and drilling. The feed range may be extended at will by means of pick-off gears. Separate 5-hp. motors provide rapid traverse. Provision is also made for applying milling feeds to the saddles and columns when required. The entire saddle is counterbalanced by means of a weight, which is self-contained within each column. Independent 5-hp. motors are used to raise and lower the saddles. Fine hand adjustment is also provided. Separate motors of 8½-hp. are also used to move each column along the bed.

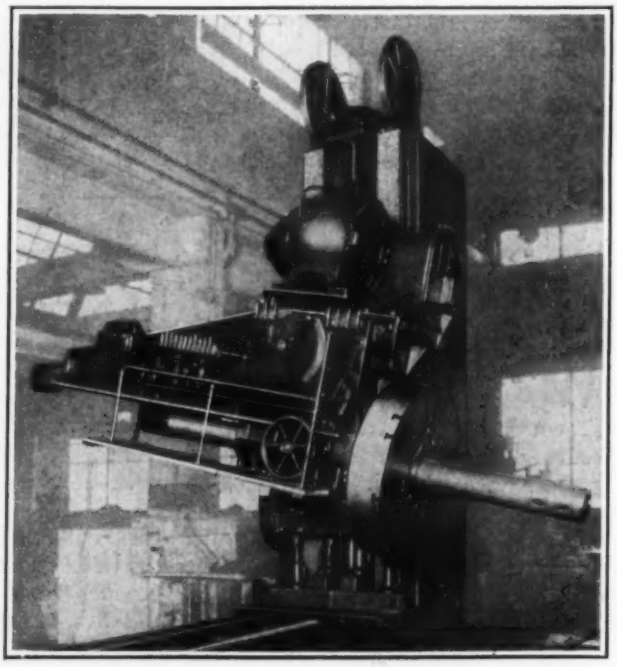


Fig. 2—Close-up view of the left-hand saddle

A large floor plate provided with conveniently arranged T-slots is bolted to the bed. The top of the floor plate is arranged so that work may be located and clamped rapidly.

Among the miscellaneous equipment supplied are boring bars, boring heads, facing heads and centering devices. Each spindle also has an outboard support for firmly holding the boring bars.

Because of the movable columns and saddles, a large working area is available and a wide variety of work can be handled.

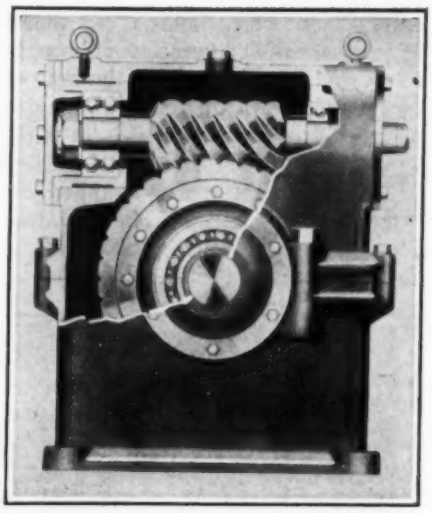
"IXL Moderntype" Worm Gearing

As a development of its line of "Hygrade" worm reducers, the Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has placed on the market the "IXL Moderntype" worm gearing. The previous units were described on page 275, Vol. 66, of the *American Machinist*.

As in the previous type, all Moderntype worms are cut integral with the shaft from alloy steel forgings carbonized, hardened, ground and polished. The worm gears are made of chilled, cast bronze, the teeth being cut with special hobs and generating machines. In sizes larger than 6¼ in. center distance, the worm gear ring is mounted on a cast-iron center. Steel centers can also be supplied when desired.

Both the worm and wormwheel are carried on anti-friction bearings. Either ball bearings or tapered roller bearings can be furnished.

The Moderntype worm gear unit employs a special form of tooth which is said greatly to reduce the frictional losses and heating effects and to insure high efficiency. Long life under continuous service and severe operating conditions is claimed. This type of worm gearing is recommended for use with almost any type and kind of machinery and industrial drives where power can be transmitted at reduced speeds. Reductions of almost any range are available from 4 to 1 up to as high as 500,000 to 1 through the use of multiple units in series.

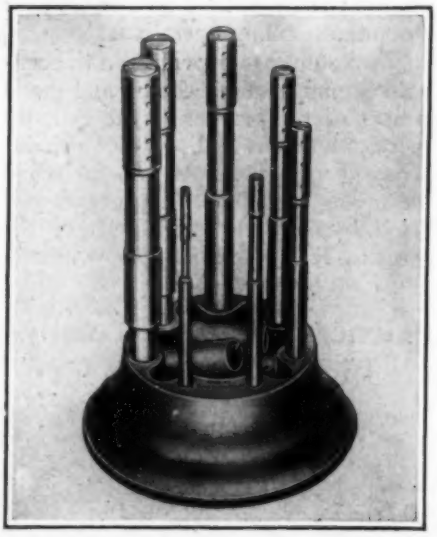


"IXL Moderntype" Worm Gear Speed Reducer

Groetchen "Copper-Head" Laps

Seven sizes of "copper-head" laps, ranging from ⅛ to ½ in. in diameter, were recently brought out by the Groetchen Tool and Manufacturing Co., 721 Fulton St., Chicago, Ill. The lap consists of a permanent steel body and a replaceable copper sleeve. In the set are included seven extra sleeves, a stand, and a quantity of Alundum abrasive grain.

The sleeve, formed from flat stock,



Groetchen "Copper-Head" Laps

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is held on the body by a tongue. It can be placed on the body either with the fold to the back, which position permits the smallest adjustment for a respective size, or with the fold to the front, where the expansion can be increased slightly. Grooves machined radially on the body and holes drilled through the sleeve serve to distribute the proper amount of abrasive. It is claimed that the lap reduces the time of operation since it cuts freely and renders a clean, true hole. The various features are patented.

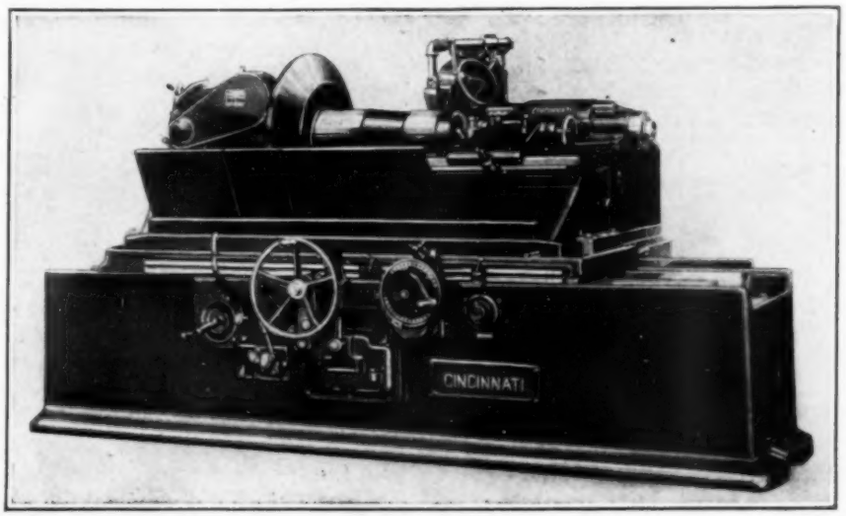
Cincinnati Heavy-Duty Spindle Grinding Machine

BY MODIFYING one of its standard machines, Cincinnati Grinders Incorporated, Cincinnati, Ohio, have built the special grinder shown in the illustration for the particular purpose of obtaining a good finish and accurate surface on large machine-tool spindles. The machine will grind work 48 in. in length. Its normal swing is 16 in., but it will swing work 31 in. in diameter through the gap in the table.

The control levers are so placed that they are easily reached by the operator from his position in front of the grinding wheel. The headstock is controlled by a lever that is connected to an electro-dynamic control panel. Proper work speeds for any diameter of work within the range of the machine can be obtained through a rheostat located at the right. The desired table traversing speed can be obtained by another lever at the right-hand side which operates sliding gears in the speed box located at the rear of the machine.

The headstock is driven from a 2-hp. variable-speed motor through a worm and wormwheel. This type of drive was selected in order to produce as smooth a drive as possible, free from vibration. The motor is set at a right angle to the line between centers so that any inherent vibration in the motor will not tend to cause chattered work.

One of the features claimed to contribute to the high accuracy obtained on the machine is the massive wheel slide. The complete assembly of the slide weighs 1,600 lb. This weight together with the downward pull of the drive belt holds the wheel slide down on the ways even under the heaviest cutting conditions. The wheel slide is in the form of a V bearing and the infeed screw is mounted directly in the center of the V, thus insuring smooth infeeding and accurate sizing.



Cincinnati Heavy-Duty Spindle Grinding Machine

The grinding wheel is 26 in. in diameter by 4-in. face, and is driven through Texropes strands from a 20-hp. motor mounted in the bed of the machine, directly below the wheel spindle. The grinding wheel spindle itself is located in half bearings of special bronze and is automatically lubricated. Oil is carried from a wall in the base of the wheel slide to the distributing pockets in the spindle cap by means of centrifugal slingers on the spindle. End thrust upon the spindle is taken up by double-row ball thrust bearings. This type of spindle mounting is claimed to stand up well under the heavy loads imposed and to be remarkably free from chatter. It requires practically no adjustment.

One of the features of the machine is the forced lubrication system used to lubricate the table ways. Pressure ranging from 2 to 3 lb. per sq.in. is obtained by means of a small geared pump, and the oil is transmitted from a central tank through a filter and into a pipe leading to the table bearings. The pump is chain driven and is self priming through a siphon action from the tank. It is arranged with an automatic pressure-regulating valve to control the flow of oil.

The oil is led up through the bed into the middle of the bed bearings. The corresponding bearing surfaces of the sliding table have headers or leads for the oil stream and oil grooves of diamond shape are placed across these headers in such a way as to give a uniform oil film over the entire table bearing surface. The oil grooves in the sliding table run out at the end, thus allowing the oil to continually pass through and drain to settling reservoirs at each end of the bed. These reservoirs are designed to hold oil at about a 6-in. head, and, by a series of baffles, the oil is allowed to flow back to the central tank, where the pump is placed. The tanks are self-contained in the bed castings and are provided with drain plugs for cleaning. This oiling system works automatically.

Rhoads Waterproof Leather Belts

All regular brands of belting made by J. E. Rhoads & Sons, 35 North Sixth St., Philadelphia, Pa., are now being supplied with waterproof cement and with a special treatment to render the belts water-resisting. In this way the belts can be used on either dry or wet conditions. Besides the waterproofing qualities, the treatment is said to increase the gripping properties. The belts are recommended for such places as dye houses, paper mills and laundries where they are exposed to water and steam.

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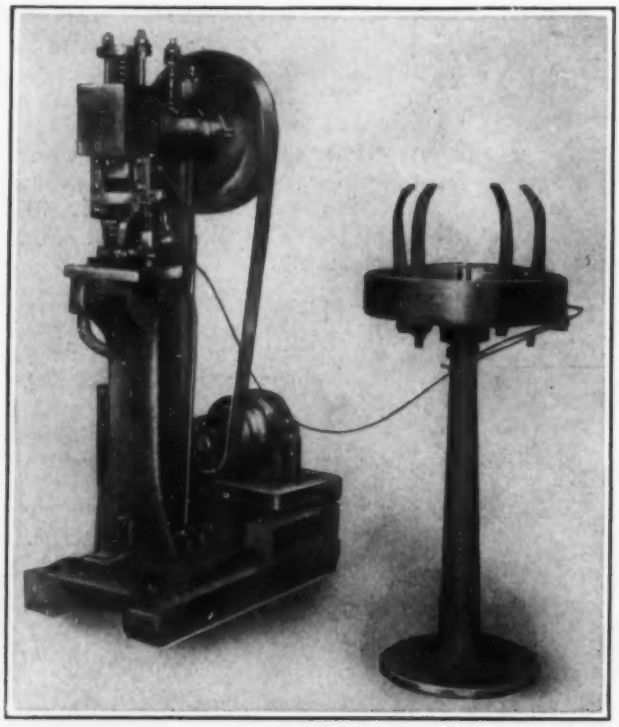
Bliss Improved High-Speed Presses

TO THE several types of high-speed presses made by the E. W. Bliss Co., Brooklyn, N. Y., the press shown in the accompanying illustration has been added. This type of press operates over a range of about 400 to 600 strokes per minute. On test it has been run as fast as 800 strokes per minute.

Since at high speeds one of the limiting factors is the clutch, in this press the shaft and clutch operate at only one-third the speed of the slide. The slide is spring counter-balanced and carries a bronze-bushed hardened roll on a hardened pin. The roll operates in oil and bears against a three-lobed cam on the driving shaft. This drive is similar to that used for the blanking and holding slides of double-action cam presses.

When this equipment is furnished on the "Bliss-Stiles" type punch presses, the slide may be stopped on every third stroke. Adjustment, if required, is provided by a wedge in the bed. When furnished on the "Bliss N-Line" presses, the clutch control can be arranged to permit stopping and starting on any stroke of the slide. The adjustment of this type of press is by means of a screw in the slide. The strokes are necessarily short for high speed work, ranging from $\frac{5}{8}$ in. on the small sizes to 1 in. on the larger sizes.

Special light feeds of both single- and double-roll types for punching and shearing work are used on these machines, but are limited in stroke and application by the speed of the operation. This type of press can also be fitted with suitable indexing feeds and can be applied to the notching of armature disks. It is shown with roll feed and reel.

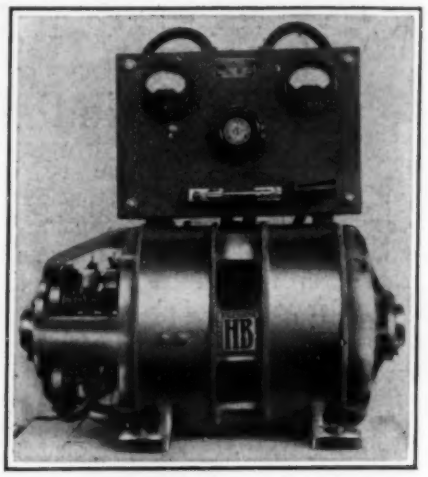


Bliss Improved High-Speed Press with Automatic Feed Attachment

"HB" Constant-Potential 8-Hour Battery Charger

Four models have been added to the line of "HB" constant-potential 8-hour battery chargers made by the Hobart Brothers Co., Troy, Ohio. These new chargers are rated at 150, 200, 250 and 300 amperes. Each unit consists of a motor-generator set of unit-type construction. Ball bearings are featured, and all models embody a non-reversing, voltage-regulator winding.

The 150-amp. outfit has a capacity for handling twenty batteries. It is a single-commutator type and furnishes current at $7\frac{1}{2}$ volts. The motor is rated at $\frac{3}{4}$ to $1\frac{1}{4}$ hp. Regular equipment includes a switchboard with voltmeter, ammeter and field rheostat, two 6-ft. connecting cables, two 8-ft. bus bars, a battery bench, thirty regular leads, three "Slo-Rate" clips and two variable-rate connectors. The motor can be furnished for use on single-, two or three-phase alternating current or for direct current. The 200-amp. outfit will handle twenty-five batteries daily. Its driving motor is rated from 1 to 3 hp. The 250-amp. outfit will handle thirty batteries daily and its motor is rated at $1\frac{1}{2}$ to $3\frac{1}{2}$ hp. The voltage in the last two cases is $7\frac{1}{2}$ volts. The 300-amp. outfit, however, is furnished in either $7\frac{1}{2}$ or 15 volts and has a capacity up to thirty-five batteries daily, and its driving motor is rated at 2 to 4 hp. For the last three models similar equipment is furnished as for the 150-amp. outfit except that a greater number of leads and clips are furnished to take care of the additional capacity. The same styles of driving motor can also be furnished.



"HB" Constant-Potential 8-Hour Battery Charger

Niagara No. 309 Horizontal Double-End Seamer

For the manufacture of grease drums and light steel containers in a wide range of sizes, the Niagara Machine & Tool Works, 697 Northland Ave., Buffalo, N. Y., has developed the No. 309 horizontal double-end seamer shown in the illustration. It is of the horizontal type and seams both ends of the drum simultaneously. This construction permits an almost automatic ejection of the finished product.

Three controlling levers are within easy reach of the operator, and a production of 300 complete small-diameter drums per hour is claimed. So-called one-time shippers of 55-gal. capacity can be double seamed at the rate of about 125 complete drums per hour.

The machine has been designed so that it will have long life under continual high-speed operation. The main spindles carrying the chucks are mounted on large Timken roller

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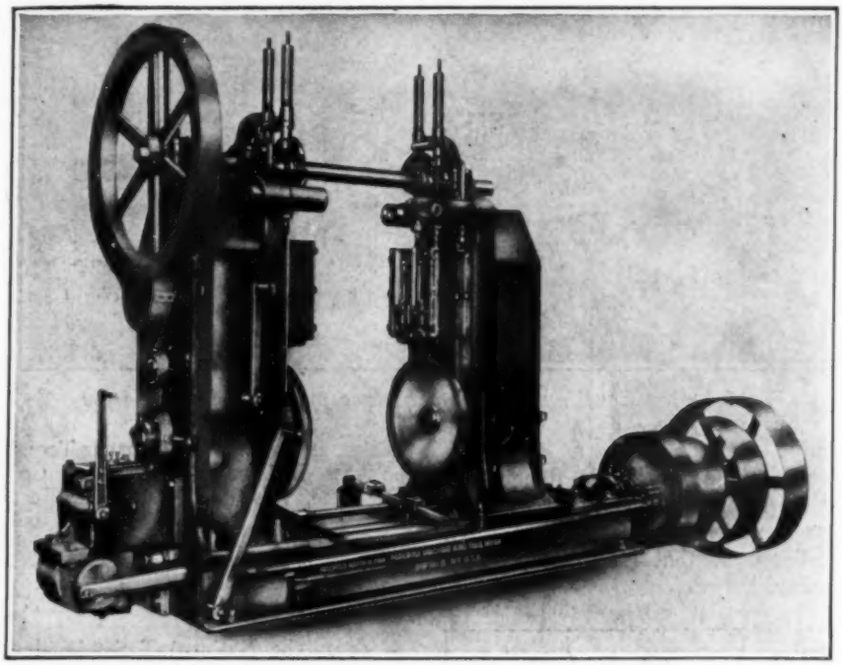


Niagara No. 309 Horizontal Double-End Seamer

bearings and the individual first- and second-operation seaming rolls also rotate on roller bearings. The motion of the right-hand column that clamps the drum and the motion of the roll cams are controlled by Johnson clutches. Rotation of the seaming chucks is effected through a large single-disk clutch. All moving parts are readily accessible for lubrication and inspection.

This machine can be built either for lineshaft drive or for individual motor drive. A 25-hp. motor is recommended in the latter case. The unit weighs complete about 10,000 lb. and is of very compact design.

Besly No. 6 Disk Grinder with Semi-Automatic Feed

A semi-automatic feeding fixture for rough grinding the sides of individual cast piston rings from the smallest up to and including rings 5 in. in diameter was recently applied to the No. 6, 20-in., dry, disk grinder made by Charles H. Besly & Co., 118 N. Clinton St., Chicago, Ill. A production of 40 to 100 rings per minute is claimed depending on the amount of stock removed and the surface area of the rings being ground.

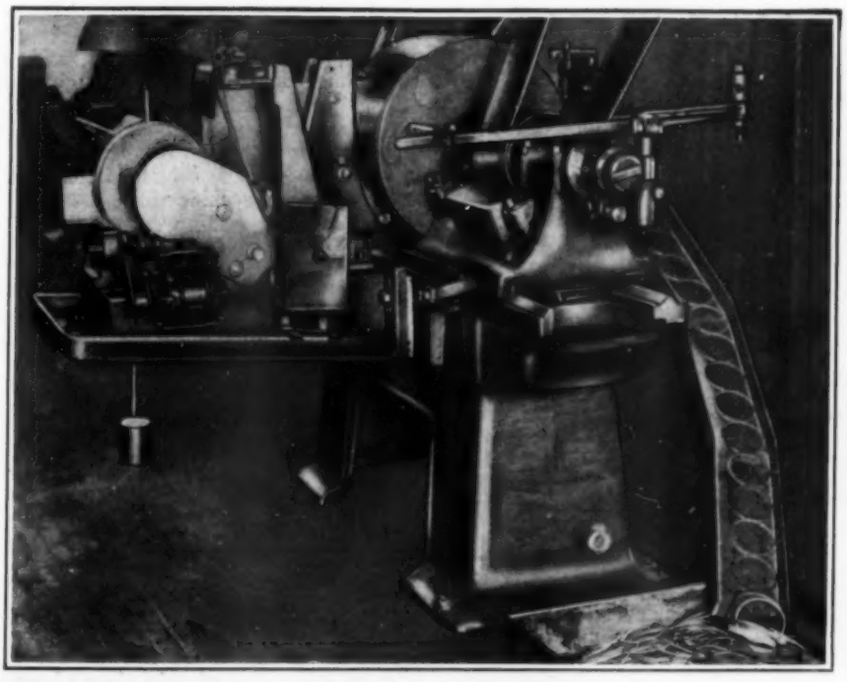
The machine uses steel disk wheels set up with No. 36 PRS Besly Titan Abrasive discs, 20 in. in diameter by ½ in. thick.

The operator places the rings in the feeding trough and the weight of the pile forces the rings against the rotary feed disk, which picks off a ring and carries it to the pressure feed roll. These rolls force the rings, with the aid of guides, between grinding disks, across the central portion of the grinding disks and out of the rear of the machine, where the rings drop into a suitable receptacle, as can be seen in the illustration.

Johnson No. 15 Direct-Jet Melting Furnace

Small quantities of lead or metal can be melted in the No. 15 direct-jet furnace illustrated, made by the Johnson Gas Appliance Co., Cedar Rapids, Iowa. The furnace is of durable construction, and it is said to give a high heating efficiency with small gas consumption. It will melt

Johnson No. 15 Direct-Jet Melting Furnace



Besly No. 6 Dry Disk Grinder with Semi-Automatic Feed

Shop Equipment News

its capacity of lead in less than ten minutes.

The pot is provided with a pouring spout and a handle. The pot is made of cast iron and is 5¼ in. in diameter by 3 in. deep. It has a capacity for holding 18 lb. of lead. The burner is one of the Johnson direct-jet, Bunsen-burner types with shut-off valve and pilot light. It consumes 15 cu.ft. of gas per hour. The unit has an over-all height of 13 in. and weighs 15 pounds.

The melting furnace was especially designed for battery stations, plumbing shops, and garages, where small quantities of metal are used.

Ajax Tension-Sleeve Flexible Coupling

This tension sleeve flexible coupling was designed by the Ajax Flexible Coupling Co., Westfield, N. Y., for particular use where quick changes of hook-up are necessary, or where it is desired to have one motor drive different machines at different times. In Fig. 1 a cross-section of the coupling is shown, while in Fig. 2 the coupling is shown applied to a stone grinding machine, where quick mounting of the drive shaft is necessary to allow for changing the grinding wheels.

The coupling is a modification of the standard Ajax rubber-bumper coupling, but is made so that the flange attached to the driven shaft is readily removable. The removable half is made with an extended split hub on the driving flange. This hub is tapered on the outside and is threaded over one-half its length, that nearest the flange. A collar made to fit over the threaded hub screws up to a tension fit, thus tightening the hub on the shaft. The hub is further held in place by set screws fitted over two sliding keys.

This type of coupling can be connected or disconnected in a few minutes, the only tools required being a pipe wrench and a set-screw wrench. The removable flange and collar are made of steel, and all other parts are identical to standard Ajax couplings, so that interchangeability is secured.

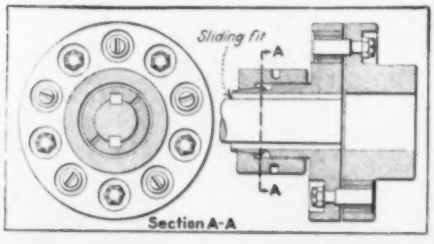


Fig. 1—Cross-sectional view of the Ajax Tension-Sleeve Flexible Coupling

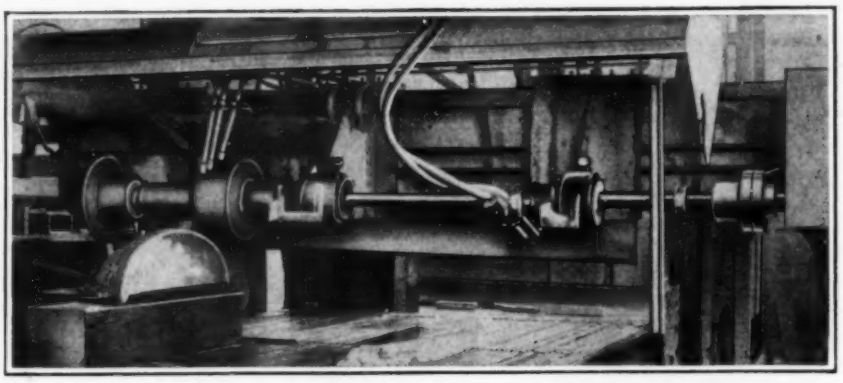


Fig. 2—Ajax Coupling applied to a stone grinding machine drive

Trade Catalogs

PLANERS, OPEN-SIDE. The Cleveland Planer Co., Cleveland, Ohio, has published an illustrated leaflet describing its improved open-side planers. Several views of the machine are shown and the chief features are pointed out in the text. Complete specifications of the full line are given.

PUNCHING AND CUTTING EQUIPMENT. The Buffalo Forge Co., Buffalo, N. Y., describes in its Bulletin No. 322-C cutting and punching equipment. This line includes the Universal Iron Worker for punching, shearing, and cutting off, the line of "Armor-Plate" punches, shears and bar cutters, a line of bending rolls, and bench and upright drills. The various circulars are in loose-leaf form and are assembled under a single cover. They are all well illustrated throughout and include complete descriptions and specifications.

STOP WATCHES. The Arthur Jackson Machine Tool Co., Toronto, through its American agent, Harold A. Symons, 33 John R. St., Detroit, Mich., has available for distribution an illustrated circular describing the line of stop watches, and production recording chronometers for scientific, industrial and general-purpose work.

STRAIGHTENING ROLLS are the subject of Bulletin 51, published by Kane & Roach, Syracuse, N. Y. The publication contains twenty 8½x11-in. pages and is well illustrated throughout by large-sized photographs. The general and specific features of each type of machine are pointed out, and the principles of straightening are explained. The complete line of this class of machinery is covered.

TEXROPE DRIVES FOR MACHINE TOOLS. The Allis Chalmers Manufacturing Co., Milwaukee, Wis., presents, largely in a pictorial way, a review of the various applications of Texrope drives for machine tools. Among the equipment shown are presses, lathes, boring machines and grinders.

TOOLS. The National Twist Drill & Tool Co., Detroit, Mich., has published a new general catalog No. 14. The line includes twist drills of all types, reamers, milling machine cutters and hobs. Some useful engineering information on gear cutting is included. The catalog contains almost 300 pages and is well illustrated throughout.

Pamphlets Received

NICKEL IN CAST IRON. The International Nickel Co., 67 Wall St., New York, has published data sheets Nos. 203 and 204 on Nickel Cast Iron. The first is entitled "The Economic Value of Nickel Cast Iron." and the second "Effect of Nickel on Machinability of Cast Iron." The last article is a reprint from the *American Machinist*. Both articles are illustrated and are technical in character.

PACKING FOR DOMESTIC SHIPMENT. The Transportation Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., has issued a series of pamphlets, Domestic Commerce Series Nos. 10 to 16, inclusive, on methods of packing for various classes of materials and in various kinds of containers. The information was prepared under the direction of the Advisory Board on Domestic Packing appointed by Mr. Hoover. Each pamphlet takes up one class of packing with full description and illustrations. The subjects covered are fiber containers, cleated plywood boxes, wire-bound boxes, cooperage and steel barrels, wooden boxes, nailed wooden crates, and baling. The pamphlets may be obtained from the Government Printing Office, Washington, D. C., at a price of 5 cents each, except for Nos. 10 and 13, which are 10 cents each.

NEWS OF THE WEEK

Gear Manufacturers Plan Winter Work

Splendid papers at Montreal—Approve continuation of standardization work by technical committees — Rochester selected for spring meeting

PLANNING for further standardization work by technical committees was the major activity at the semi-annual meeting of the American Gear Manufacturers' Association, held Oct. 20-22, at the Mount Royal Hotel, Montreal, Canada, with a registration of a few more than fifty. As a result of the work accomplished at the Jackson, Mich., meeting, in May, where recommended practices were adopted for eleven potential standards, there was a scarcity of material for presentation at Montreal. The way was thus left open for the technical standards committees, which met in round table discussions, to perfect plans for future work. Much was accomplished at these meetings.

Progress reports were presented by several of the committees. Of especial interest and importance were the reports of the bevel gear committee on nomenclature and the spur gear committee on spur gear standards tables. Further reports from these committees and reports on the new work planned at Montreal will be given at the 1928 spring meeting, to be held during April in Rochester, N. Y. The report of the secretary, T. W. Owen, told of the activities of the office since the preceding meeting.

Three new member companies were elected:

Fairfield Manufacturing Co., Lafayette, Ind., A. J. McAllister, executive representative.

Perkins Machine and Gear Co., Greenfield, Mass., J. L. Perkins, executive representative; F. L. Peabody, associate representative; J. Oakley, associate representative.

Goodman Manufacturing Co., Chicago, Ill., W. T. McCullough executive representative.

John T. Howat was elected an additional associate representative from the R. D. Nuttall Co., Pittsburgh, Pa.

The membership learned, with great regret, of the illness of past-president George L. Markland, Jr., of Philadelphia, and upon motion of honorary president F. W. Sinram it was unanimously voted to send the association's expression of sympathy and good wishes to Mr. Markland.

As customary, several technical papers were presented. All were relevant to the activities of the association, were well received, and discussed:

"Some Observations on the Making of American Standards," was the title of a paper by Clifford B. LePage, assistant secretary of the A.S.M.E.

George H. Acker, chief engineer of the Cleveland Worm and Gear Co., had submitted a paper, "Worm Gear Inspection and Testing," read, on account of his absence, by H. J. Eberhardt.

"The Effect of Hob Corrections on Gear Teeth" was presented by James A. Hall, professor of mechanical engineering, Brown University, and consulting engineer, Brown & Sharpe Manufacturing Co.

A. A. Ross, of the General Electric Co., spoke on "Marine Gear Drives."

"Reds, Radicals and Reformers" was the topic of a non-technical address by Herbert D. Casey, superintendent of schools, Easthampton, Mass.

President Frost on "Responsibility"

Under the title, "Our Responsibility," president E. J. Frost counseled the members of the association not to let down in their present work, and to consider with open minds the possibilities of broadening the work to the ultimate advantage of the member companies. He said, in part, "Let me refresh your memories as to what we say we are banded together for:

"The discussion of subjects of interest and value to the industry in which its members are engaged.

"The advancement and improvement of that industry.

"The collection and dissemination of statistics and information of value to its members.

"The standardization of gear design, manufacture and application.

"The promotion of a spirit of co-operation among its members for the improved production and increased application of gears.

"Going over these aims in their order:

"We certainly have not discussed all of the subjects of interest and value to the industry.' Right now, after more than ten years of association activity, we are beginning to discuss the subject of the standardization of hobs, to do away, so far as possible, with the myriad of designs now on the market, and for which you pay, not alone in increased first cost, but in minimized adaptability, due to vagaries of tooth form, diameter of bore, or size of keyway.

"Do you think that we as individuals, or even collectively, know all that we can or should about the suitability of various steels for different uses? Don't you think that we might even go as far afield in our search for useful knowledge as to let specialists talk to us on such subjects as proper illumination of our shops, the latest advancement in cutting tools such as gear and milling cutters, the proper protection of our plants against fire hazards, the elimination of monetary loss due to industrial accidents, or even have someone check us up to see how much (or how little) we know about fire insurance and what our policies actually cover?

"Wouldn't you feel well repaid for your trip to the meeting if, when you reached home after listening to such a talk as last mentioned, you checked up and found you had been paying premiums for ten, fifteen or perhaps twenty years, on values on which you could not recover a penny in insurance if you did have a fire?

"The 'advancement and improvement of the industry' opens up a wide field of association effort, and though we have done something along this line, there is still much to be done. We should carry on with the work on the Lewis machine at the Massachusetts Institute of Technology in reference to tooth wear and deflection under load, and get these experiments reduced to practical information that can be used by all of our shops in our quest for better gears.

"We should, through our contacts at the meetings, attempt to bring about more intelligent and uniform methods

of cost finding. We are the victims of our own folly when we let ignorance or cupidity, or both, lead us into quoting prices that will no more than cover the cost of the raw material, and it is almost equally bad on the faith of our customers when we name prices way beyond any justification in material and manufacturing costs.

"Through our Library Committee we are doing a very constructive piece of work in 'The collection and dissemination of statistics and information.' The current bibliography ought to appeal to all of us, and the tables and data sent out from time to time should be of much value to our engineering staffs.

"Our commercial standardization has also been of service in the past, and can continue to be so by sending out periodically to the membership information regarding the trend of business in general and in specific lines, and could also get from us figures that would show, in the aggregate, such things as investment in land and buildings, equipment, raw materials, work in process, sales, etc., so that as an industry we could compare our efforts and the return on our investment with other occupations.

"We next come to what, in some ways, has proved to be our big endeavor, or at least what has received most attention and most recognition from the technical press; this is, 'The standardization of gear design, manufacture and application,' and we may well be proud of what we have done, still hoping for greater achievement; not being content until all suitable material has been submitted to the Engineering Standards Committee, and through them has become an adopted American standard.

"Lastly, we come to the final object of our existence, which is, 'The promotion of a spirit of co-operation among its members for the improved production and increased production of gears.' This leads me to reassert what I and some others have repeatedly stated: That, if we did nothing else than get together twice a year, learn to call each other by the first name, put our feet under the same dinner table, play together a little, and talk over our common problems even without a thought of a fixed program, or interesting speakers, we could go home feeling well repaid.

"In closing, let me say that the gear business is a swift, though interesting game, and it doubtless will continue to call for as great or greater exertion of brain and brawn as it now does, and woe betide that plant that does not continually keep setting its house in order by keeping pace with the times in manpower, machinery, methods and management; the four M's of industry."

LePage Says Standards Are Vital

Mr. LePage contended that the formation of national, or "American Standards," is a natural evolution. He said:

"The members of this Association need not be reminded that the setting up of engineering and industrial standards does not retard invention and progress. You all feel that when new methods and devices have demonstrated their superiority over the old ones, modification is inevitable. You agree also that standardization does not necessarily involve the idea of actual perfection. It is rather the setting up for a time that which is best in present practice.

"I am sure that your experience will prompt you to agree further with a prominent worker in this field when he says, 'Every problem of standardization may be divided into the technical and the human side, and in most cases the human side is well over 85 per cent of the total. The technical factors are usually so well known that the problem, so far as they are concerned, becomes one of basic facts rather than one of opinion. But when we come to deal with the human side so very little is known of the reasons actuating us all that we have to deal largely with so-called human or personal opinion, which sometimes is not too closely related to the facts.'

"The economic aspects of standardization are, of course, pre-eminent. It is this consideration which often prompts the acceptance of less than a complete job. Development toward an ideal through the process of time is generally less expensive. Good business practice also requires that the standards developed should have a certain measure of permanency. It is this economic or business side of the question which prompts many to believe that in most cases the initial proposals should come from the manufacturers. It is in turn recognized, however, that often the consumers of a product are the proper group to initiate the project when the best interests of the producer, of the consumer and of the general public are considered on a fair basis.

"The principal aim of this paper is to discuss with you for a few minutes the proposition: that the establishment of national or 'American Standards' by the present A.E.S.C. method or a similar one is a logical development in American industry. I am interested in this proposition because I firmly believe that national or 'American Standards' are more effective in the long run than company or association standards.

"By its recent official act this Association has taken membership in the American Engineering Standards Committee, and in so doing has placed itself in the company of those who hold this view; but I firmly believe that the nine year's experience of the American Society of Mechanical Engineers with the A.E.S.C. method, has developed a technique, a knowledge of which may be helpful to the A.G.M.A. During that period of time the A.S.M.E. has organized or helped to organize 24 Sectional Committees, a phrase which means in this country that the committees in question were organized under the procedure of the American Engineering Standards Committee. One of these Sectional Committees is that on the Standardization of Gears, of which Mr. Benjamin F. Waterman is chairman, and Messrs. A. W. Copland, H. F. Eberhardt, F. E. McMullan, E. W. Miller and J. C. O'Brien are the other A.G.M.A. representatives.

"The first argument which I present in support of the proposition that the formation of national or 'American Standards' is a natural evolution, is founded on the fact that the standardization process rightly conceived and executed is a dynamic or vital process. In the words of one of your members, 'it consists in blazing a trail of progress, without which we lose all advantages of experience and laboriously explore the same ground over and over again, traveling often in circles, instead of advancing steadily toward that perfection of design or performance which is our ultimate objective.'

"In your company practice you have formulated certain standards of design, quality of material and performance which have helped to reduce the tedium of the day's work and helped to make it run more smoothly. In a sense you formed industrial habits which were good or bad in proportion to the wisdom which entered into its formation. These standards or habits were only a means to an end. Better standards or habits followed. Later, with the organization and functioning of this Association and its Standardization Committee, A.G.M.A. Standards were developed, by the general consent of its members, which embodied the best of the experiences recorded in the several company standards. What more natural step in this evolution can be taken now, therefore, than the development of national or 'American Standards' by common agreement among consumers, general interests as well as the manufacturers?

"My second argument for national standards is that their development gives the consumer an opportunity to have a voice in the establishment of standards for products which he intends to purchase. As you know, there is a growing sentiment among purchasers favorable to the use of purchase specifications of some kind. In buying and selling there are two interested parties, and standard specifications are of advantage to both. The users' interest in such standards centers around (a) interchangeability of component parts, (b) prompt filling of orders from the stocks of the manufacturer, (c) ready replacement of damaged and worn parts, (d) avoidance of misunderstanding by a uniform nomenclature, and (e) not infrequently the reduction of the selling price. In a word, he has interests which are similar in some respects to those of the manufacturer, but which are enough different to justify his having a place in the standardization program. While you gentlemen are manufacturers of gears and gear drives, you are at the same time purchasers of tools and materials. You have recognized the importance of standard specifications for

cast iron, steel and bronzes intended for your use, and the Association has set up standard specifications for these materials. Not only that, but the second proposed American Standard developed by the Sectional Committee on the Standardization of Gears is one on 'Forged and Rolled Carbon Steel for Gears.' Concerning this part of the project the A.G.M.A.'s interest is that of a consumer.

"The third and last support which I will present to this proposition is that there is inspiration, enthusiasm, and economy in group action. The A.E.S.C. procedure calls for the organization of Sectional Committees which are broadly representative of the social and the economic interests of producer, consumer and general public. This provision fits in with the principle previously stated, that the making of standards is a vital process. Consequently, it is most successful in the long run when carried on in a way which fits in readily with our normal social and economic life."

Mr. LePage then described the principle steps in the development of a standard project under the procedure of the A.E.S.C.

Other Papers on Modification of Hobs, Inspection and Lubrication of Gears

Prof. Hall's paper was primarily concerned with the relation between the modification of the hob and that of the gear tooth, rather than with the proper form of tip relief, and gave the methods developed by the Brown & Sharpe Manufacturing Co. for the study of this problem. Equations and curves were given for determining the tip relief, radial relief, and entrance angle on any chosen size of gear when cut with a hob of known shape. Using the hobs with straight line corrections, methods of determining the hob shape to yield to any desired tip and radial corrections were developed. Curves for determining the number of teeth in contact and for showing the relation between normal correction and tip correction were given.

In addition to explaining methods of inspecting and testing worm gears, Mr. Acker made statements concerning his observations in connection with the lubrication of such gears:

"The general trend of the past few years toward higher operating speeds and more compact mechanisms has given rise to a continual process of development in the manufacture of worm gearing. Harder, stronger, gear materials have been developed to meet the demand for compactness, and this change, with the increasing operating speeds, requires far greater accuracy of manufacture that has been customary. To meet these new conditions, new testing methods are continually required.

"The following are some of the potential sources of error in worm gearing that must be guarded against by suitable inspection: Eccentricity of worm; correct sizing of worm; index of worm thread; lead of worm thread; angle of gear; eccentricity of gear; silence."

Mr. Acker then described a bridge gage used to check the eccentricity between worm threads and bearing seats and to gage the size of the worm; a fixture for testing the spacing of the worm threads; and a machine for checking lead.

Control of materials also was taken up, as was the subject of lubrication: "We may say that the functions of a worm gear lubricant are to reduce the sliding friction of the worm on the gear, preventing metallic contact, and to carry heat from the gearing at a rate sufficient to prevent undue local heating.

"In regard to the first requirement, the oil must have a body sufficient to prevent squeeze-out under load, yet must have a low coefficient of fluid friction that will circulate readily in the gear case to prevent local heating of the gears.

"Assuming that we have a perfect lubricant for the gearing, we would find that the limit of loading would be reached when the bronze in the gear started either to flow or pit, dependent upon the nature of the load, and the bronze. These phenomena would definitely establish a rating, or limiting load, on the gearing. Unfortunately, the characteristics of the various known lubricants do not conform to the requirements of perfect worm gear lubricant, and it is therefore necessary to make a careful study of each special application, to select the lubricant that most closely approaches the ideal over the probable range of operating conditions.

Effect on Oil Film

"In worm gearing operating at high speeds the worm exerts a certain amount of hydroplaning action on the oil, and the rolling action is rapid. These conditions are very favorable to the formation of an oil film. Further, the dwell, or increment of time, in which a given tooth contact exists, is relatively brief, so that the time available for squeezing out the oil is slight. Consequently, a relatively light-bodied oil can be used to carry safely all the load that the bronze gear will stand at high speed.

"If, however, the same oil is used at very low speeds, where the dwell of the teeth in contact is greater, and the hydroplaning action is negligible, the load borne by the oil safely will be a small percentage of that carried at high speed. To realize fully the load-carrying capacity of the bronze gear, therefore, a much heavier lubricant is required at low operating speeds, and such a lubricant can be safely used, because of the low fluid velocities that prevail."

New Plan for Public Works Offered

With the support of Secretary Hoover of the Department of Commerce, and of Secretary Work of the Department of the Interior, the American Engineering Council has adopted a new plan of executive re-organization affecting public works which, it is believed, will meet with favor in Congress and end a movement for administrative reform lasting forty years.

The council has recognized political expediency, without sacrificing the essential principle involved in centralizing and placing on a business basis the enormous public works functions of the Federal Government with which in the past, it is charged, waste and inefficiency have been associated.

The proposals of the engineering profession have been embodied in a bill to be introduced at the coming session of Congress by Representative Adam M. Wyant, of Pennsylvania. Adoption of the measure, according to the engineers, will mean savings annually of millions of dollars, create a modern industrial organization, and constitute a big advance in accomplishing the administrative reforms begun under President Harding.

The new legislative program of the engineers, with whom are allied sixty other national organizations, has been sanctioned by letter ballot of the administrative board of the American Engineering Council, composed of thirty engineering societies.

Plans to further this program were made at a two-day meeting of the board in York, Pa., Oct. 20 and 21, under the auspices of the York Engineering Society.

The most striking feature of the new engineering policy is the abandonment of the idea of creating a Department of Public Works to replace the historic Department of the Interior. The engineers contend that they never have advocated the creation of a new federal department. They have decided, however, that to insist on the change of name, even though no new department was contemplated, is politically unwise.

They felt, Dean Kimball said, that both Congress and the Administration would be opposed to the formation of a Department of Public Works; hence an effort in that direction would be futile.

Under the new scheme a major Division of Public Works would be created in the Department of the Interior, and would be directed by an Assistant Secretary of Public Works who shall be an engineer. This division, which, it was declared by Mr. Wallace, secretary of the council, has the approval of Secretary Work, will embrace all of the Federal agencies concerned with public works functions.

Secretary Hoover, the report stated, has also endorsed this plan, and both he and Secretary Work are expected to make strong speeches in behalf of its enactment into law.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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THE story of last week's business may be summarized by saying that President Coolidge expressed enthusiastic satisfaction with our present prosperity and the prospects for its continuation, and that the stock market declined more violently than at any time since last August. These apparently incongruous facts epitomize the entire business situation, for during most of the year we have watched the discordant combination of a moderate recession in trade and industry and a rising stock market, and now it will be no more illogical to witness declining prices for stocks even if, as many expect, business shows the usual seasonal improvement this autumn.

Mr. Coolidge said, in digesting the reports made to him by Cabinet officers, that the much discussed slackening in building is not as great as many observers believe; the falling off in rail earnings does not signify lessened expenditure for transportation because automobile traffic has increased; the railroads are soon expected to buy more iron and steel; the coal strike is virtually settled and heavy buying orders for winter are yet to be placed; only twenty-seven strikes are reported in the whole country; all crop conditions seem favorable except cotton, which receives the compensation of a higher price as compared with last year; increased mail order sales confirm the fact of agricultural prosperity, which means better business for everybody; exports and imports are larger in quantity than last year; and liberal credit stimulates buying and makes generally for good times. Therefore he discovers nothing upon which to base any unfavorable expectation for the future.

But the problems that now confront the business man are not those of commerce or industry, but of finance. They have been created by the enormous expansion in credit which has occurred in a time of comparatively slow trade, and by its use almost exclusively in financing the purchase of securities, of real estate, and in other activities that are largely speculative.

The magnitude of this credit expansion is made clear by comparison of the present with conditions three years ago, when the "Coolidge boom" was inaugurated on Election Day, 1924. Gold holdings have not increased greatly in that time, for on Oct. 1 they stood at only $4,581,829,000 compared with $4,547,785,000 on the same date in 1924. But a vastly greater credit structure has been erected upon them. Loans and discounts of the larger member banks of the Federal Reserve System, which constitute less than half of the country's total volume of bank credit, have increased $2,253,000,000, from $12,786,000,000 to $15,039,000,000. Of that increase only $635,000,000 has been in commercial loans which now make up $8,841,000,000 of the total. Loans on securities have risen from $4,579,000,000 to $6,197,000,000, a gain of $1,618,000,000. In addition the banks' own investments have increased from $5,449,000,000 to $6,067,000,000 or $618,000,000, making a total increase in credit placed in securities of $2,239,000,000. For brokers' loans in New York no authentic comparisons are available, but against an estimate of $1,475,000,000 in October, 1924, they now total approximately $4,000,000,000, according to the Stock Exchange figures.

The danger in this expansion is that the loans on securities thus made cannot be rediscounted at the Federal Reserve Banks and when and if the limit of their loaning power is reached the member banks will be compelled first to offer their eligible commercial paper for rediscount with quick effect on the money market and the Reserve Banks' position, and then to reduce their security loans and sell some of their investments. When that time comes there may be as great a dearth of buyers as there has been thus far of sellers, and the consequence will be a collapse of inflated values so severe as to shock business immeasurably and give to trade a setback from which recovery is bound to be tortuous and depressing.

This picture is presented not because its realization is necessarily imminent, but because if the end of the path we are following is put plainly in sight we may be able to apply a brake to our progress and perhaps to retrace our steps with a minimum of discomfort. In that respect the decline which has already occurred in the stock market and which gained speed last week, is encouraging. It has already gone further than most of us perhaps realize.

It is not impossible that the recessions which occurred last week in some of the principal organized commodity markets are due more to a subconscious fear of financial shock than to the statistical or other causes commonly assigned for them.

In the two major industries October production is relatively low. In automobiles it is probably the lowest of the year, but much optimism is expressed on the ground that sales will increase greatly when the Ford car is finally offered, probably by the middle of November. The iron and steel reviews quite logically herald price cutting as a sign that improvement in demand is not far off.

WHAT'S DOING IN INDUSTRY

FIGURES on the total volume of October sales are not available as yet, but from the nature of current reports it is fairly certain that they will be satisfactory. General activity among users of machinery and machine tools is increasing, and as soon as the automobile industry goes ahead with its winter production schedules a better condition is expected throughout the industry.

IN DETROIT, where this activity is centered, there are certain well-defined signs of improvement, and in Cincinnati, a prominent manufacturing center, a decided increase in sales and inquiries is reported. Industrial users are furnishing a fair amount of business in Chicago. Cleveland notes a slightly better tone, with small orders in good volume. Conditions are fairly satisfactory in Milwaukee.

FAVORABLE signs continue in Buffalo, and machinery sales are increasing. Current bookings in New England should keep producers moderately busy for the balance of the year. Sales in the New York district are spotty, replacement business being the mainstay of the market.

A GENERAL tendency toward an upward revision in machine tool prices is reported. This tendency will probably become more significant next month and its effect on sales should furnish some interesting observations.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

DETROIT

Conditions in the machinery market here have shown a slight improvement within the last week. Orders are coming in with a fair degree of regularity and an increase in the number of inquiries has been noted in some fields. However, the long anticipated break has not yet materialized and it still seems likely that nothing will happen until the new Ford car comes out.

It is true that Ford, Dodge, Oakland and Chevrolet have done some buying, but not to the extent that dealers here believed they would. All that can be said for the market is that there is a slight upward trend, that the feeling is good and that there is every indication that the coming year will be a significant one for the trade.

Employment has changed little and the general economic situation has remained at a standstill within the past few weeks.

NEW YORK

Little change is reported by dealers and manufacturers' agents in the machinery and machine tool market in this territory. Business is spotty and in some lines is rather uncertain in its trend.

The feature of the present market is the lack of inquiries that would ordinarily lead to orders. Most of the sales recorded today are the result of individual effort on the part of salesmen. Replacement of obsolete tools is practically the only source of business. Expansion of production is furnishing very little.

Comment is heard here and there of a revision in prices—upward. Two definite instances were mentioned by dealers and it is expected that many machinery manufacturers will follow the lead of the first formal announcements.

Two large automobile manufacturers are listed as buyers in the past week. One of these placed an order for 14 lathes and a vertical shaper; the other bought a thread miller and a rotary surface grinder. The Northern Pacific Ry. and the New York Central R.R. made purchases of a few tools each. General industrial users are the most active supporters of the present market.

CINCINNATI

Machine tool manufacturers in the Cincinnati district state that in the past week the sales curve has ascended, and many express the opinion that a better market is developing. An increasing amount of favorable reaction from the recent machine tool exhibits is reported, but the greatest benefit of these is not expected to be immediate. Selling agents report that the market is improving.

Orders booked in the past week were well scattered over the country and well diversified as to sizes and types. The great majority of them called for single tools and replacements, coming from general machinists and miscellaneous users. A number of scattered single orders came from railroads, and from the automobile and electrical fields.

The feature of the past week's inquiries was a list from the Norfolk & Western R.R., calling for a large number of tools, large and small. The greater part of the week's inquiries, however, were in regard to single tools and replacements.

Manufacture was at a good level through the week, and in view of the fact that the market is showing a tendency to improve, some manufacturers are making preparations for increasing production.

CLEVELAND

A slightly better tone is evident in the local machinery and machine tool market. Orders for single pieces comprised the bulk of the business received in the past fortnight. An order for twenty pieces of wood working machinery from a large furniture manufacturer was the outstanding order received. More interest is being shown at the present time and it is believed that the remainder of the year will show an increase in business.

The most encouraging feature of the local trade is the increase of sales in the automatic machinery line. This branch of the industry has enjoyed good business for the last two months. September was the best month of the year. The automotive line is furnishing the largest amount of orders. Production will be increased in the near future.

The planer division is active and an increase in new inquiries is noted. The American Steel and Wire Co., is planning to spend $2,000,000 for extensions to its Cuyahoga Works plant.

BUFFALO

Favorable conditions continue in the machine tool trade in Buffalo. There are more inquiries and more actual sales than was the case in either August or September, and there is every indication that the improvement will continue throughout the balance of the year.

Orders are not large but they are coming from a wide variety of sources showing that there is something of a buying movement on in industry generally in this district. The demand for used equipment also persists.

The electrical equipment phase of the business is in a position similar to that of machine tools. Business is fairly good and is increasing. Inquiries are more frequent than in weeks.

CHICAGO

General industry is furnishing such business as is reported by manufacturers of and dealers in machine tools. Market conditions are practically the same as have existed for the last few weeks. Sales of single tools or small lots constitute the bulk of the business reported. Inquiries are being received in satisfactory number, but the closing of sales is exasperatingly slow in most cases, especially where the inquiries refer to equipment of expensive type.

Small tools are in good demand. Local representatives of hacksaw and bandsaw manufacturers report trade as on the up grade. Demand for woodworking machinery is on an improved basis. Railroads continue to inquire for prices on tools of various types to be included in 1928 budgets, but otherwise are showing no interest in the market.

Demand for used tools is spotty, dealers generally reporting but little business doing. Salesmen covering the Chicago district are bringing in a large proportion of the orders taken for used machinery in first-class condition.

NEW ENGLAND

Improvement in the number of orders booked in the New England territory continues, and production schedules are being speeded up. Opinion is general that October bookings will assure production activity for the balance of the year. Some of this business is the result of recent machinery expositions. Special machinery business now appears very favorable.

The Skayef Ball Bearing Co. has under consideration plans for expansion of its plant at Hartford. These plans contemplate setting up equipment for production in certain lines now carried on at the company's plant in Sweden.

Substantial automotive equipment orders came into the New England territory during the past week. Railroad equipment orders in small units were placed.

MILWAUKEE

October is proving a fairly satisfactory month for most of the builders of metal working equipment in this vicinity, although the sales curve has flattened out somewhat after exhibiting an upward trend earlier in the month. The demand is not quite as spotty as it was during the summer, but the volume of sales remains limited, due largely to the relative inactivity of buyers in the automobile industry

Industrial employment continues to expand moderately, with fewer concerns losing ground. September registered a gain of slightly over 1 per cent over August, and October is expected to show an equal increase.

In view of the fact that the agricultural equipment industry has been rather a poor customer of the machine tool trade for a number of years, the present activity is formidable by comparison and is one of the high lights of the situation. Railroad buying, however, is a disappointment.

PHILADELPHIA

A spotty condition prevails in the market for machinery and machine tools in Philadelphia. Manufacturers and dealers reported that a few orders had been received and that inquiries were fairly hopeful, although the situation was far from satisfactory.

The Rayon Silk Co. has placed a fairly sizable order with a Philadelphia firm producing textile machinery. Gear manufacturers have found some business from chemical works and purchases have been made by contractors for special equipment Manufacturers of abrasives report a fairly good period of activity during the last fortnight.

Optimistic expressions that the automotive industry will soon develop were made by some of the leaders of the industry. Dealers and producers of equipment for general industrial purposes reported that the early part of October held up, although profits were not as great as they had been when conditions were more brisk.

Tax Reduction, Flood Control and Civic Development Recommended by Chamber

Self regulation of business again advocated

PURSUANT to a new plan, about 400 members of the U. S. Chamber of Commerce met at West Baden, Ind., over last week-end for a four-day meeting, packed with the sessions of committees, councillors and members of the board of directors. The sessions closed Oct. 18. Of first importance were reports on Mississippi flood control, tax reduction and a new civic objective for business. Additional subjects covered in general meetings were a project for getting out the vote at elections, reduction of postal rates, maintenance of the integrity of the Federal Reserve System, self regulation by business, the part played by member organizations in legislation and the relation of these organizations to the public and the press. Twenty different committees held meetings, reviewed the progress of their work, and, where advisable, laid out new plans. As always, at U. S. Chamber of Commerce meetings the attendance included a large number of the leaders of American business, both from industry and trade. General judgment was that this new plan of grouped committee and national councillors meetings was a success, enabling all groups sharing in the chamber's work to advance materially their activities.

Flood Committee Report

Mississippi flood control was presented through addresses by Lewis E. Pierson, president of the chamber; John M. Parker, former governor of Louisiana; and through a report of the chamber's flood committee headed by Frederic A. Delano, as chairman. The report was ordered to be made the basis for referendum to chamber members. It recommends "(1) that the federal government should hereafter pay the entire cost of constructing and maintaining the works necessary to control the floods of the lower Mississippi, that is from Cairo to the Gulf; (2) that the federal government should assume the sole responsibility for locating, constructing and maintaining such works; (3) that there should be an adequate appropriation to insure efficient, continuous and economic work, the funds to be made available as needed; (4) that flood control on the Mississippi is a work of such magnitude and urgency that it should be dealt with in legislation and administration upon its own merits, separate and distinct from any other undertaking." These recommendations were supported by the report with its various appendixes and exhibits.

In tax reduction the chamber is now asking member organizations to vote on a suggestion that the corporation income tax be reduced from 13½ per cent, as now, to 10 per cent. The chamber's committee, as already announced, asks a total tax reduction of $400,000,000. Reductions advocated include the abolition of the federal inheritance tax and excise taxes imposed as war measures.

The committee on civic development suggested that American business take as its guide in all activities objectives set forth in the preamble to the federal constitution, namely, "to form a more perfect union, establish justice, insure domestic tranquillity, provide for the common defense, promote the general welfare and secure the blessings of liberty for ourselves and our posterity."

The committee on postal service advocated the elimination of the higher rates made effective in 1925 on private mailing cards and circular matter, and also war rates on advertising in magazines and newspapers. This committee showed that the Post Office Department has lost revenue through these increases and that the existing rates are handicapping business.

Harry A. Wheeler, president of the Union Trust Co., Chicago, discussed the benefits of the Federal Reserve System and urged strong defense of the system by business. Improvements are to be expected but fundamentals should not be altered.

Judge Edwin B. Parker, chairman of the board of directors of the chamber, advocated regulation of business by itself, asserting that if it does not do so, the Government will. He commended the helpful attitude of the Federal Trade Commission in desiring to assist business to work out rules of business conduct in the interest of business itself, but in a manner to safeguard the interests of the general public.

The president, Mr. Pierson, in closing the sessions, pointed out that the national councillors present had a grave responsibility, for on them rested the task of taking back to their organizations the problems studied by the chamber and there creating that informed public opinion which will bring its influence to bear on Government for the common welfare.

Gary Celebrates Its 21st Anniversary

"Greater Gary Discovery Day" was celebrated on Oct. 12 with a long list of civic ceremonies culminating in a banquet in the evening at which several of the country's leading industrialists were the guests of honor. The celebration was in honor of Gary's twenty-first birthday.

Back in 1906, when Gary was founded, the population was around 1,000. Now the city claims 112,000 souls and seriously contends with Pittsburgh in steel production.

Among the out-of-town visitors were James A. Farrell, president of the United States Steel Corporation; E. J. Buffington, B. F. Affleck, Samuel Insull, Senator Arthur Robinson, Representative Will R. Wood and Gov. E. Jackson of Indiana.

At a banquet which more than 500 industrialists and leading citizens of Gary attended, a vacant chair occupied the head of the speaker's table in memory of Judge Gary, the city's benefactor who was to have been the principal speaker at the banquet, as he was at a similar function twenty years ago.

Machine Tools Increase Productive Ratio Fifty Times

Mechanization and improved organization have so improved the productivity of the manufacturing industry in the United States since the beginning of the century, that on an average 67 workers in 1925 produced as much as 100 men turned out in 1899, despite the shorter hours now prevailing. This is brought out in a study of productive efficiency made by the National Industrial Conference Board.

If the productivity of industry through mechanization should continue to increase in the same manner and at the same rate for the next 25 years, it would at the end of that time require but 45 men to produce what now requires a force of nearly 70, and which a little more than 25 years ago necessitated the employment of 100 men. Such calculation, however speculative it may be, does not overdraw the striking advances constantly being made in the way of mechanization and more efficient co-ordination of effort in manufacturing processes. Iron screws, for instance, are now being made by automatic machinery at a ratio of about 1,000 to every 1 formerly made by hand; spikes are being turned out by machinery at a ratio of 200 to every 1 previously turned out by hand, and in various other processes of the metal trades industry, such as boring, broaching, tapping, counter-sinking, reaming and milling, mechanization has increased productivity at a ratio of about 50 to 1 per worker. Other industries, as for instance the iron and steel industry, the textile and textile products industries, shoe manufacturing, bottle blowing, baking, and printing all have undergone similar changes through mechanization.

The increase of productive efficiency achieved by mechanization varies in the different industries, and has been most striking in the newer industries which are less handicapped by old established customs of procedure. An outstanding example is the automobile industry, which in 1925 required less than a third as many workers to produce a given number of cars than it did in 1914. The rubber industry has advanced almost, but not quite as rapidly. In the leather and in the lumber industries, on the other hand, it takes about the same number of workers to turn out a given quantity of product as it did 25 years ago.

Personals

CHARLES L. LAWRANCE, president of the Wright Aeronautical Corporation, sailed for Europe on Oct. 8.

C. F. CLARKE has been re-elected president of the Monroe Steel Castings Co., Monroe, Mich.

J. V. NEUBERT has been appointed chief engineer, maintenance of way division, of the New York Central R.R.

W. R. HUNTLEY has been elected president of the Buffalo General Electric Co., succeeding the late Charles R. Huntley.

C. W. AVERY, chief development engineer for the Ford Motor Co., has resigned to become associated with the Murray Corporation of America, in Detroit.

R. L. AGASSIZ, chairman of the Calumet & Hecla Consolidated Copper Co., was re-elected president of the Copper and Brass Research Association at a recent meeting.

A. B. DETTMER has been appointed works manager of the National Tool Co., of Cleveland. He was formerly plant engineer for the American La France Fire Engine Co., at Elmira, N. Y.

E. A. THORNWELL has been appointed representative in Georgia and eastern Tennessee for the Lincoln Electric Co., of Cleveland. John Van Horn factory engineer for the company, has been assigned to the Atlanta office to assist Mr. Thornwell.

T. LATIMER FORD has been elected vice-president of the American Hammered Piston Ring Co., of Baltimore, Md. Mr. Ford has been associated with this company for many years, for the past five years in charge of the Pacific Coast territory.

Gen. Carty Awarded Fritz Medal

The John Fritz Gold Medal for 1928 has been awarded to Gen. John J. Carty, of New York, for achievement in telephone engineering. This annual award was made unanimously by the board of sixteen representatives of the American societies of civil, mining and metallurgical, mechanical, and electrical engineers, having an aggregate membership of 57,000.

The presentation of the medal will take place in February, 1928, in connection with the annual meeting of the American Institute of Electrical Engineers, in the Engineering Auditorium, New York. The medal will be presented to General Carty by Robert Ridgway, chairman of the board which made the award.

Will Entertain British Air Secretary

Sir Philip A. G. D. Sassoon, British Under Secretary of State for Air, is visiting in the United States. When he returns from a trip to the Middle-West, the Aeronautical Chamber of Commerce proposes to entertain him at a banquet in New York City in conjunction with our Under Secretaries for Aeronautics of the War, Post Office, Navy and Commerce Departments.

It is expected that this will be a very interesting and important occasion. The tentative date for the dinner is Thursday, Nov. 3, at a place to be announced later.

"Drive Right" Wins

A. W. Moseley, mechanical engineer of the Sloan Valve Co., Chicago, won the contest conducted by the Power Transmission Association for a slogan. Mr. Moseley's winning slogan is "Drive Right" and was the unanimous choice of the judges for first place. The judges were: L. C. Morrow, R. R. Leonard and H. D. Edwards, all members of the A.S.M.E. The final design and emblem embodying the slogan will be adopted by the association at the annual meeting on Dec. 7, at the Hotel Commodore, New York.

Mr. Moseley has written a number of papers on a number of subjects. Some of his papers and discussions have been printed by the A.S.M.E. and he has co-operated in the production of some technical manuals.

Business Items

The King Pneumatic Tool Co., of Chicago, has moved its plant to 2717 North Ashland Ave., in that city.

The Chicago Pneumatic Tool Co., of New York, announces the removal of its Cleveland District sales office to 1727 Union Trust Bldg., in Cleveland.

The Rollway Bearing Co., of Syracuse, N. Y., has opened a branch sales office at 956 Leader Bldg., in Cleveland. R. D. Faris has been appointed district manager in charge.

The Brown Instrument Co., of Philadelphia, has opened a branch office at Kansas City. The office is located in the Mutual Bldg., and is in charge of F. M. Poole, district manager.

The Valley Motor Truck Co., Inc., Elkhart, Ind., has purchased a part of the plant of the Noyes Carriage Co., and will spend considerable money for new machinery and expects to be in full operation in the new plant by the middle of November.

The Indiana Smelting and Refining Co., of Indianapolis, requests the alteration of a news item that appeared some time ago to the effect that its plant had been badly damaged by fire. The actual damage was slight and caused no interruption of plant operation.

Stockholders have been asked to ratify a proposed merger of the Dudlo Manufacturing Corporation, the Rome Wire Co., the Safety Cable Co., the Underground Cable Co., and the Baltimore Copper Smelting and Rolling Co. The combination will be known as the General Cable Corporation.

The property of the Columbia Nut and Bolt Co., at Bridgeport, Conn., was sold at public auction on Oct. 13 to A. G. Leake, of the Leake & Nelson Co. Buildings on the property include a one-story structure, a two-story building, and four smaller one-story structures. The machinery which was not moved to the plant of the Atlantic Manufacturing Co. when the business was taken to Milford, was sold to J. L. Lucas & Son, of Bridgeport.

The Hart & Hegeman Manufacturing Co. and the Arrow Electric Co., both of Hartford, Conn., have been merged through the formation of a holding company under the name of Arrow-Hart & Hegeman, Inc. Both companies manufacture electric wiring devices and switches and the new corporation has been formed with a view to economizing in the manufacture of these products. Edward R. Grier, vice-president and general manager of the Arrow Electric Co., has been named president of the holding company.

Ryerson Takes Over Foote-Burt Drills

Joseph T. Ryerson & Son, Inc., with offices in twenty cities throughout the country, have taken over the distribution of the Foote-Burt line of drills to the railroads. This line of railroad drilling equipment fits in well with the other tools and equipment which the Ryerson company is now selling to the carriers. Foote-Burt equipment includes machines for single- and multiple-spindle drilling for a great variety of work such as mud rings, flue sheets, etc. The new Foote-Burt catalog is now available.

Obituaries

PERLEY F. WALKER, dean of the College of Engineering at the University of Kansas, died suddenly on Oct. 17 at Lawrence, Kan. He had been connected with the faculty of the university since 1905.

CHARLES M. MANLY, engineer and designer of airplane motors, died at his home in Kew Gardens, Long Island, N. Y., on Oct. 16. He was noted as an inventor and was vice-president and chief engineer of the Manly Drive Co., which manufactured one of his patents. He was president of the Society of Automotive Engineers in 1919. During the World War he was consulting engineer and assistant general manager of the Curtiss Aeroplane and Motor Co.

Forthcoming Meetings

American Institute of Steel Construction. Annual convention at Pinehurst, North Carolina, Oct. 25 to 29. Charles F. Abbott, executive director, 285 Madison Ave., New York City.

National Association of Manufacturers. Annual convention, Read House, Chattanooga, Tenn., Oct. 25, 26 and 27. George S. Boudinot, secretary, 50 Church St., New York City.

American Society of Mechanical Engineers. National management meeting, Rochester, N. Y., Oct. 26-27. Charles W. Lytle, chairman, Management Div., 29 W. 39th St., New York City.

National Founders Association. Convention, Hotel Astor, New York, N. Y., Nov. 16-17. J. M. Taylor, secretary, 22 S. La Salle St., Chicago.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York City, Dec. 5 to 8. C. E. Davies, assistant secretary in charge of meetings, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Sixth annual event in the Grand Central Palace, New York, Dec. 5 to 10. Charles F. Roth, manager, Grand Central Palace, New York City.

Power Transmission Association. Annual meeting, Dec. 7, Hotel Commodore, New York City. W. S. Hays, secretary, Drexel Bldg., Philadelphia.

American Association for the Advancement of Science. Second Nashville meeting, Nashville, Tenn., Dec. 26-31, general headquarters Andrew Jackson Hotel. General chairman, W. S. Leathers, M.D., professor of preventative medicine and public health, Vanderbilt Medical School, Nashville, Tennessee.

The Weekly Price Guide

Rise and Fall of the Market

CURRENT demand for fabricated steel structurals shows improvement over that of a week ago. Black steel sheets rose 25c. per 100 lb., Oct. 18, at Pittsburgh mills. Most of the price changes of the week were in a downward direction. Declines occurred in the following: tank plates, copper tubing, solder, and antimony, at Cleveland; solder, heavy copper and wire scrap, at New York; blue-annealed sheets at Pittsburgh. Wrought-steel pipe prices display weakness for the first time in four years. Buying has slowed down perceptibly in pig-iron, scrap, strip steel, plates, and track supplies. Minimum on the principal hot-rolled steel products is $1.75 per 100 lb., base, Pittsburgh; current maximum on plates and shapes, base, is $1.80 and on bars (billet steel) $1.85 per 100 lb., f.o.b., mill.

(All prices as of Oct. 21)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	17.75
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00@5.25
Cincinnati	4.30
New York	4.75@5.25
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.25	3.50	3.25	3.89
No. 12	2.15@2.30	3.55	3.30	3.94
No. 14	2.20@2.35	3.60	3.35	3.99
No. 16	2.30@2.45	3.70	3.45	4.09
Black				
Nos. 18 to 20	3.05	3.75	3.55	4.00
No. 22	3.20	3.90	3.70	4.15
No. 24	3.25	3.95	3.75	4.20
No. 26	3.35	4.05	3.85	4.30
No. 28	3.60	4.20	4.00	4.45
Galvanized				
No. 10	3.15	4.10	3.95	4.25
Nos. 12 to 14	3.25	4.20	4.05	4.35
No. 16	3.35	4.30	4.15	4.45
No. 18	3.50	4.45	4.30	4.60
No. 20	3.65	4.60	4.45	4.75
No. 22	3.70	4.65	4.50	4.80
No. 24	3.85	4.80	4.65	4.95
No. 26	4.05	5.05	4.90	5.20
No. 28	4.30	5.30	5.15	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
⅛ to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
¼	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	¾	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
065"	16	.19	.20	.21	.22	.23	.25	.27
083"	14	.20	.22	.23	.24	.25	.27	.29
095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
120" or 125"	11	.23	.25	.27	.28	.29	.31	.33
134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn, round and hex.†	4.00	3.65	3.60
Cold drawn, flats and squares	4.50	4.15	4.10
Structural shapes (base)	3.34	3.00	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.65	3.65
Tank plates (base)	3.34	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼ 7.35c. per lb. *Flat, 1/16@½-in. thick. †Shafting and screw stock

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots

Copper, electrolytic, up to carlots, New York			14.50
Tin, pigs, 5-ton lots, New York			60.62½
Lead, pigs, up to carlots, E. St. Louis	6.05	New York	6.87½
Zinc, slabs, up to carlots, E. St. Louis	6.00	New York	7.00

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	13.50	14.00	13.00
Copper sheets, base	22.00	22.00	22.00
Copper wire, base	18.75	18.75	15.25*
Copper bars, base	21.50	21.50	21.50
Copper tubing, base	24.00	24.00	24.00
Brass sheets, high, base	18.25	18.25	18.25
Brass tubing, high, base	23.12½	23.12½	23.12½
Brass rods, high, base	16.00	16.00	16.00
Brass wire, high, base	18.75	18.75	18.75

*Mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	26@27	26.02
Zinc sheets (casks)	11.00	11.55	10.11
Solder (½ and ½), (case lots)	36.25	37.00	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	78.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	12.50

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	37.00
Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper	11.25 @11.50	10.75	10.00@10.50
Copper, heavy, and wire	10.75 @11.00	10.75	9.75@10.25
Copper, light, and bottoms	9.75 @10.00	9.25	8.75@ 9.25
Heavy lead	5.00 @ 5.25	5.25	4.50@ 5.00
Tea lead	4.00 @ 4.25	3.75	3.50@ 4.00
Brass, heavy, yellow	7.00 @ 7.25	7.00	6.75@ 7.25
Brass, heavy, red	8.75 @ 9.00	9.50	8.75@ 9.25
Brass, light	5.25 @ 5.50	5.50	5.75@ 6.25
No. 1 yellow rod turnings	7.25 @ 7.50	7.00	6.75@ 7.25
Zinc	3.75 @ 4.00	3.25	3.00@ 3.50

TIN PLATES—Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@ .17
Wiping cloths, washed white, per lb	.15½	36.00 per M	.15
Sal soda, per lb	03½	.02	02½
Roll sulphur, per lb	027	03½	04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	86½	.94	.79
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.65	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	.27	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	35%	35%	35%
Heavy grade	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%@60%
Second grade	50–10%	60–5%	50–10@60–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.16	.16	.1662½
Solder (½ and ½)	per lb.	.36½	.38½	.4362½
Cotton waste, white	per lb.	.10@13½	10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.10
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	.27	.27	35
Belting, leather, medium	off list	35%	40–5%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville,	2.75@3.00
Coke, prompt foundry, per net ton		Connellsville,	4.25@4.75
White lead, dry or in oil	100 lb. kegs	New York,	13.75
Red lead, dry	100 lb. kegs	New York,	13.75
Red lead, in oil	100 lb. kegs	New York,	15.25

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1¼ and 1½ in. dia.	35%
Carriage bolts:	
Up to ¾ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ¾ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in, incl.	55%
Semi-finished, hexagonal, tapped, in packages all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb.	$3.50*
Rivets, button and cone head:	
Small, including ¼-in. dia	50–10%
Large (base) per 100 lb. net	$5.00†

Less than case or keg quantities on bolts, screws, hot-pressed and cold-punch nuts, add extra of 10 per cent to list.

*$1.50 off list on broken keg lots. †$6.50 broken keg lots net.

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Amesbury—J. McLane, Clark and Elm Sts.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $40,000.

Mich., Detroit—Williams Mfg. Co., 4860 St. Aubin Ave. (die makers)—milling machine.

O., Akron—L. C. Darkow & Son Inc., 70 East Miller Ave., L. C. Darkow, Pres.—metal working machinery including 24 in. lathe, stamping machine, etc., for proposed machine shop.

O., Cleveland—Bd. of Education, East 6th St. and Rockwell Ave.—will receive bids until Nov. 14 for a B. and S. Universal milling machine for Cleveland Trade School.

O., Madison—Iron King Co., (farm implements) equipment including lathe and sheet metal machinery for plant at Avery, O.

O., New Bremen—Streine Tool & Mfg. Co.—heavy duty turret lathe, similar to Foster machine or Warner & Swasey, not less than 20 in. swing; heavy duty lathe, 36 in. swing; 8 or 10 ft. cylindrical grinder, 10 in. maximum diameter; Ingersoll slab milling machine with planer type table, No. 5 milling machine, plain type and 42 in. vertical boring mill (new or used) for proposed extensions and improvements to plant.

Tex., San Benito—Southern Iron & Machine Co., F. H. Wedegartner, 362 North Bowie St.—machinery and equipment including moulds, drill presses, pressers, cutters, etc. for the manufacture of irrigation gates, etc., to cost $25,000, for recently acquired plant.

Ont., Beachburg—Blackwell Garage Co.—complete machinery and equipment for proposed auto repair shop.

Ont., Hamilton—Dominion Sheet Metal Co.—machinery and equipment for the manufacture of sheet metal for proposed 1 story, 100 x 175 ft. factory. Estimated cost $40,000.

Que., Chicoutimi—W. Blanchette—complete machinery and equipment for sawmill.

Opportunities for Future Business

Calif., Redwood City — Sequoia Union High School Dist., plans an election to vote $150,000 bonds for addition to high school including shops, etc.

Colo., Pueblo — Midwest Steel & Iron Co. awarded contract for second unit of plant, 1 story, 50 x 54 ft., also addition to present shop, 16 x 96 ft. on East Northern Ave. Estimated cost $45,000. Noted Apr. 7.

Colo., Pueblo—Pueblo Aircraft Inc., c/o H. Petersen, Atty., First National Bank Bldg., plans the construction of an airplane factory. Estimated cost $100,000.

Conn., Waterbury — American Fastener Co., 54 Maple St., is receiving bids on revised plans for a 4 story, 40 x 105 ft. factory on Maple St. Estimated cost $75,000. C. J. Bailey, 63 Bank St., Archt. Noted Sept. 15.

Ga., Atlanta — General Motors Corp., General Motors Bldg., Detroit, Mich., plans the construction of a 350 x 800 ft. assembly plant to include 160 x 680 ft. Fisher body unit, 120 x 200 ft. parts building, 40 x 200 ft. office building, etc., for Chevrolet Motor Co. Estimated cost approximately $5,000,000.

Ga., Atlanta—The Watkins Mfg. Co., H. Gee, Jr., Wichita, Kan., has acquired a site and plans the construction of a rebabbitting plant here.

Ga., Nashville—H. C. Powell, L. B. Gaskins and C. Harris, have acquired a site and plans the construction of a plant for the manufacture of machinery used for the spraying of crops.

Ill., Chicago — Dallas Brass & Copper Works has work under way on the construction of a brass and copper mill at 66th Ave.

Ill., Chicago—Raffel Mfg. Co., 4441-47 Armitage St., awarded contract for a 2 story, 48 x 125 ft. addition to machine shop at 4449-51 Armitage St. Estimated cost $25,000.

Ill., Chicago—S. J. Richman, 11 South La Salle St., plans the construction of a 6 story, 130 x 230 ft. garage etc. at 5961-6017 Broadway. Estimated cost $750,000. Architect not selected.

Ill., Chicago — Riverside Iron Works, awarded contract for a 1 story, 50 x 50 ft. factory at 10625 Buffalo Ave.

Ill., Chicago—South Chicago Auto Radiator Works, 2838 East 91st St., awarded contract for a 1 story, 30 x 50 ft. factory at 9331 Chicago Ave.

Ind., Indianapolis — General Insulating & Mfg. Co., has work under way on the construction of a 104 x 128 ft. plant.

Md., Baltimore — Lock Insulator Corp., Charles and Cromwell Sts., awarded contract for a 1 story, 40 x 60 ft. press room and 2 story, 34 x 74 ft. boll mill building, etc.

Mr., Baltimore — Owens & Sisco, Continental Bldg., Archts., will receive bids until Nov. 1, for the construction of a 1 story sales and service station at 29th St. and Remington Ave. for Wilson-Nash Motors Co., 29th St. and Remington Ave. H. F. Doeleman, 516 North Charles St., Engr.

Mass., Worcester—F. W. Taylor, 438 Main St., will build a 2 story work shop etc. at 404 Main St. Estimated cost $50,000. Cutting, Carlton & Cutting, 44 Front St., Archts.

Mich., Detroit — Backus Fordon & Co., First National Bank Bldg., is having plans prepared for an 8 story, 138 x 160 ft. garage on Fort St. Smith, Hichman & Grylls, 800 Marquette Bldg., Archts.

Mich., Detroit—City is having plans prepared for the construction of a 2 story, 50 x 200 ft. garage, etc. at Frank and Lynch Sts. Estimated cost $150,000. P. A. Fellows, City Hall, Engr.

Mich., Detroit—Detroit Motor Parts Co., 11801 Mack Ave., awarded contract for a 1 and 2 story, 140 x 427 ft. factory. Estimated cost $125,000.

Mich., Detroit—J. H. Gustav Steffens, 415 Brainard St., Archt., will receive bids until Oct. 29 for the construction of a 3 story, 30 x 60 ft. machine shop, for Kermath Mfg. Co., 5890 Commonwealth Ave. Estimated cost $50,000.

Mich., Flint—The A. C. Spark Plug Co., Industrial Ave., awarded contract for a 1 story, 84 x 364 ft. factory. Estimated cost $40,000.

Mich., Highland Park (Detroit P.O.)—Chrysler Motor Corp., 341 Massachusetts Ave., is having plans prepared for the construction of a 4 story, 60 x 400 ft. automobile factory. Smith, Hinchman & Grylls, 800 Marquette Bldg., Detroit, Archts.

Mo., Independence—Clay & Bailey, 7007 East 15th St., Kansas City, have acquired a site and plans the construction of a foundry here.

N. J., East Orange—Baldwin Construction Co., 614 Central Ave., awarded contract for a 2 story, 120 x 200 ft. garage at Railroad Plaza and Halstead St. Estimated cost $150,000. Noted Oct. 6.

N. J., Hoboken—Furguson Bros. Mfg. Co., 832 Monroe St., manufacturers of furniture, will build a 2 story factory at 704-720 Monroe St. Estimated cost $200,000. G. S. Schlick, 136 Liberty St., New York, Archt.

N. J., Newark—G. Bell, c/o R. B. Stroutenburgh, 60 Park Pl., plans the construction of an 8 story 200 x 250 ft. garage at Washington and Warren Sts. and Warren Pl. Estimated cost $1,000,000. Architect and engineer not announced.

N. J., Newark—Hygienic Tube Co., 88 McWhorter St., is having revised plans prepared for the construction of a 1 story, 100 x 100 ft. factory at Ave. L. and Mary St. Estimated cost $40,000. A. Peter, 207 Market St., Archt. Noted Aug. 11.

N. Y., Brooklyn—Mansfield Iron Works Inc., 878 East 43rd St., has acquired a site and plans the construction of a steel fabricating plant at East Mill Basin. Estimated cost to exceed $50,000.

N. Y., New York—Manhattan Athletic Club, c/o M. H. Osborne, 92nd St., plans the construction of a 5 story, 50 x 100 ft. garage at 45 West 66th St. Estimated cost $200 000. M. W. Whinston, 116 West 39th St., Archt.

N. Y., New York—Shakespeare Building Corp., 277 Broadway, will build a 2 story, 100 x 120 ft. repair and service garage on Cromwell Ave. Estimated cost $100,000. Franklin, Bates & Heindsmann, 2526 Webster Ave., Archts.

N. Y., Richmond Hill — Keiner-Williams Stamping Co., 8746 123rd St., has work under way on the construction of a factory. Estimated cost $75,000.

O., Cleveland — The American Steel & Wire Co., H. L. Schuler, Engr. of Construction, Jones Rd., plans the construction of a plant to include 70 x 480 ft. mill building, 24 x 70 ft. rod mill, 24 x 70 ft. storage building, etc., on East 29th St. Estimated cost $750,000. Private plans.

O., Cleveland—Champion Machine & Forging Co., L. W. Greve, Pres., 3695 East 78th St., awarded contract for a 1 story, 89 x 178 ft. addition to factory. Estimated cost $40,000. Noted Oct. 6.

Okla., Tulsa — S. J. Caudill, Atlas Life Bldg., awarded contract for a 6 story, 50 x 140 ft. garage on Boulder St. Estimated cost $200,000.

Pa., Philadelphia — J. Warren Watson Co., 24th and Locust Sts., manufacturers of stabilators, will soon award contract for a 2 story, 84 x 207 ft. addition to factory. Ballinger Co., 12th and Chestnut Sts., Archt.

Pa., Sharon—Sharon Steel Hoop Co., will build a 1 story, 70 x 100 ft. machine shop. Estimated cost $50,000. Private plans. Noted Oct. 6.

R. I., Providence—J. Conn., 104 Broad St., is receiving bids for the construction of a 3 story garage at Broad and Chestnut Sts. Estimated cost $150,000. T. J. H. Pierce, 30 Allens Ave|, Archt. Noted Aug. 11.

S. C., Spartanburg — The Mountain City Foundry & Machine Works, 200 Academy St., Greenville, has acquired the plant of the Standard Iron Works and plans extensions and improvements to foundry and machine shop.

Tenn. Morristown — National Steel Stamping Corp., J. C. East Main St., recently incorporated for $50,000, plans the construction of a plant for the manufacture of steel ends for school desks, opera chairs, etc. to include machine shops.

Va., Richmond—C. A. Levine has acquired a site and plans the construction of a factory for the manufacture of airplanes, here, also at Long Island, N. Y.

W. Va., Charleston—State Road Comn., awarded contract for the construction of a 3 story garage. Estimated cost $75,000.

Ont., Ottawa—Bryson Estate is receiving bids for addition to garage on Albert St. Estimated cost $75,000. Richards & Abra, 53 Metcalfe St., Archts.

Ont., Toronto — Willys-Overland Ltd., Weston Rd., awarded contract for a 1 and 2 story, 67 x 200 ft. addition to automobile factory. Estimated cost $175,000. Noted Sept. 15.